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## THE DYCHE MUSEUM AT THE UNIVERSITY OF KANSAS<sup>1</sup>

By Dr. ALEXANDER WETMORE

ASSISTANT SECRETARY, SMITHSONIAN INSTITUTION

SOME years ago I found myself a graduate from Montgomery County High School in Independence, Kansas. The study of birds was a paramount interest with me and I had aspirations for college. Iowa, California, other places, offered inducements, until a friend loaned me a catalogue of the University of Kansas and I learned of the University Museum, now the Dyche Museum. Among other descriptive details I read of a collection of Central American birds. Foreign birds at the time were unknown to me, except for a few that I had seen in circus menageries or

stuffed in the parlors of friends, and were an irresistible attraction. I decided at once that the courses in biology offered at K. U. were the ultimate of my desire, and in September several days before the fall term opened I was in Lawrence. My first visit to the "Hill" led me to the cool great hall of this museum, and in this building it was my fortune to spend much of my time during my undergraduate years.

The foreign birds, I may add, proved to be the Gaumer collection from Yucatán, given by an alumnus who had worked with Snow and with Dyche, and who later had settled in Mexico. No one had studied these specimens, so that I had the keen delight of identifying and labeling many of them—and since I have known most of them in their native haunts in life.

<sup>1</sup> Address given at the reopening of the Dyche Museum during ceremonies on the occasion of the seventy-fifth anniversary of the founding of the University of Kansas, June 6, 1941.

I go back in my mind on this occasion beyond L. L. Dyche, for whom this museum is named, to Francis Huntington Snow and his work as the pioneer in natural science in Kansas so far as this university is concerned.

Early expeditionary parties sent out by the government to survey the West often crossed through Kansas, and their naturalists made many observations that have much value to workers of to-day. But it is to Snow that we owe the foundation of these studies on behalf of our alma mater. The story of his work has been told most sympathetically and understandingly by Dean Stouffer in a recent number of the *Graduate Magazine*, and the value of his teachings has been demonstrated by the accomplishment of his many students. As a freshman I came too late to have the privilege of attendance in his classes, but profited by his friendship in the later years of his life when he had retired from his administrative duties but was still occupied to the exclusion of other interests with the collections of insects that he had assembled.

As one more story of Dr. Snow's industry, in addition to those told by Dean Stouffer, may I relate the following. I returned to the university one year in midsummer with a collection of skins of birds that I had secured in northern Arizona. Work in the laboratories began for me at eight in the morning, but through rising at six I could reach the museum by seven and so have an hour for research on my specimens. But any feeling of personal vanity at this display of energy was humbled in me completely by the fact that each day as I came toward the building I met Dr. Snow coming down the hill on his way to breakfast after having spent two hours or more at work in the early morning. And often late in evening I saw lights in the windows of his study. That I knew Francis Huntington Snow has been one of my treasured memories.

Lewis Lindsay Dyche was one of Dr. Snow's students who remained at the university, first as an assistant and later as a member of the professorial staff. Dyche was interested especially in field work and the collecting of specimens, and for his period was a notable traveler. New Mexico, northern Minnesota, California, Greenland and southeastern Alaska, among many other places, were known to him, and from his travels in what were then wild places he returned to the university with skins and skulls and skeletons of deer, caribou, walrus, seals, polar bears, mountain sheep, goats, smaller mammals and birds, many of which were mounted in life-like attitude and which to-day form the nucleus of the groups shown in our renovated museum.

For years Professor Dyche traveled through Kansas to tell in high schools and other halls the story

of his adventures illustrated with stereopticon pictures of the places that he had seen. Undoubtedly it is these lectures that made him one of the best-known members of the university faculty of his day throughout the state, and that helped to persuade reluctant legislators of the desirability of a special museum building to house the collections that he and others had made.

The World Columbian Exposition held at Chicago in 1893 gave Professor Dyche definite opportunity, and there he received great acclaim for his panorama display of mounted mammals in a semblance of their natural habitat. It was this idea of a panorama exhibition that controlled the early installation of the displays in the Dyche Museum when it was finally completed. Little did I imagine when as a very small boy I marveled at Professor Dyche's specimens at the Fair in Chicago that I should later have some hand in their arrangement and care in the museum of this university.

The other collections housed in this building, in which Dyche had no hand, and often little interest, have equal importance in the attraction that the University Museum has for the constant procession of students with their families and their friends that come to its doors. The fossils, great and small, of the paleontological display, gathered under Williston, McClung and Lane, with Handel T. Martin as their early preparator and guardian, with their story of the past have awed and attracted thousands who have carried away from their visits impressions impossible to have been gained in other fashion. The many birds, mammals and reptiles are a constant source of study, and other creatures have come in for attention. The collections housed here are notable for an institution of this kind.

When in the history of mankind museums began is a matter concerning which we have no definite information. Man as a thinking animal is naturally curious about his surroundings and also acquisitive in gathering those concrete things that are attractive to him. Primitive man's first museum specimens no doubt were unusual objects that excited his interest, that he carried with him to his cave or shelter for further examination, or perhaps to prove to his wife and friends that his story about them was really so. Such interests must go far back in the history of the human race. In the United States National Museum in Washington we have on exhibition a replica of the two European bison modeled in clay by Pleistocene man in the cave of Tuc d'Audobert in southern France. Archeologists regard these as primitive magic concerned with the increase and abundance of the herds of wild game. This may well be, but to me as I stand before this case the figures represent the museum

exhibits of Aurignacian man of twenty thousand years ago. The horses, bison and birds drawn by early man of the same period on the walls of caves in the mountains of Spain must also represent early exhibitions of human art. That they have been preserved to the present day is one of the miracles of chance for which we must be forever grateful.

Aristotle, the father of modern natural history, was befriended by his pupil Alexander the Great, who assigned a considerable force of men to secure for him oddities in birds and beasts. It is related also that Ptolemy the first, in the famous library at Alexandria in Egypt, had what was in effect a museum and a university in combination, though we have little record of what was in it except for reference to manuscripts. More recently, in a palace at Ur dating about 3000 B.C., there has been found a labeled series of objects of archeological interest that evidently constituted a museum collection. We are told too that fossils and other curios were kept in some of the temples of the Greeks during the thousand-year period before the Christian era. These illustrate something of the little that we know of the beginnings of museums and are sufficient to indicate the definite antiquity of man's museum interest.

The oldest of existing museums had their foundations in the voyages of exploration of the fifteenth century. Columbus was charged by Queen Isabella to collect strange birds, and it is recorded that he took back to Spain from his voyages the skins of various beasts. We are told that in his triumphal parade in Barcelona, in April, 1493, there were displayed live parrots and the skins of birds. Men of wealth of this period of extensive exploration in new lands began to maintain collections of various kinds, and interest in natural history as a science became wide-spread. Such a collection was that of Sir Hans Sloane which, in 1753, became the foundation of the British Museum of Natural History, one of the great institutions of its kind in the world.

In the early days of the historical period in the New World our own country was the source of much natural history material that went abroad, but museum interest came early among the colonists of what is now the eastern part of the United States. Without going into too much detail, there is record in the year 1750 of a "Repository of Curiosity" at Harvard College, which included "horns and bones, fishes, skins and other objects." This was destroyed by fire in 1764, but in 1769 a room was set aside in the college for a "Musaeum." Thus began the present-day Museum of Comparative Zoölogy, of Harvard College. Among other existing institutions the museum in Charleston, South Carolina, was founded in 1773, and that of the Academy of Natural Sciences in Philadelphia in 1812.

That there are to-day throughout the world more than 7,000 museums of which more than 1,000 are in the United States is a fact in itself significant in establishing the worth and value of the museum as a cultural feature of our modern life. Also significant is the fact that approximately 25,000,000 persons visit our American museums each year.

In considering American museums and their present place in our lives it is pertinent to say something about our National Museum in Washington, since it is this organization that has been a constant example in the development of museum projects with a more local field.

The Smithsonian Institution had its beginning in a bequest of money from James Smithson, an Englishman, who died in Genoa in the year 1829. In his will Smithson left his estate to the United States of America to found at Washington, under the name of the Smithsonian Institution, an "establishment for the increase and diffusion of knowledge among men."

In the minds of many there is some confusion with regard to the relation between the Smithsonian Institution and the United States National Museum. The two are distinct, though many consider them as identical. In brief, the Smithsonian is a privately endowed organization that in the course of its history has developed, at the expense of its own funds, various activities that have been publicly accepted as important so that as they grew beyond Smithsonian means they have been supported by governmental appropriations. As examples of these I may mention the National Museum, the Astrophysical Observatory, the National Zoological Park and the Bureau of American Ethnology. The National Museum then is a bureau or branch supported by the government, under the administration of the Smithsonian Institution, which still contributes largely to museum researches and adds to its specimens through the income from its endowments. In fact, the Smithsonian administers various funds that have been given entirely for the support of collections in the museum.

The act of foundation of the Smithsonian provided that it should include a museum for objects of natural history, plants and geological, mineralogical and other specimens belonging to the Government. Under this provision there came to it immediately the collections made by the Wilkes Exploring Expedition, which under an appropriation of one million dollars was engaged from 1838 to 1842 in an exploratory journey around the world.

From small beginnings the United States National Museum has grown until it is one of the greatest that exists. Its collections now comprise more than 17,000,000 catalogue entries, and are valued at more than \$150,000,000. This appraisal is made with the

statement that with ten times that sum of money available the collection could not be duplicated, because of the many unique things that it contains.

From the vast collections of this museum's five departments many specimens are arranged for exhibition in the public halls. That this forms an attractive feature to those who come to our capitol city is indicated by the figures of the last fiscal year when our visitors included more than two million five hundred thousand persons. On public view there are found such objects of patriotic interest as the original flag that, flying over Fort McHenry, inspired Francis Scott Key to write "The Star Spangled Banner," the sword and other relics of General Washington and similar articles from scores of other persons famous in American history. Airplanes, engines, early types of horse-drawn vehicles and ancient automobiles, and scores of important patent models attract hundreds to the engineering exhibits. Skeletons of huge dinosaurs and other animals of the past, groups of mounted animals collected in Africa by Theodore Roosevelt, birds, reptiles, life-size models of Indians and other peoples in their appropriate dress fill the halls of the Natural History Building.

But in addition to these public displays there are even more valuable study collections, arranged properly for reference in the museum laboratories, that are in constant use for scientific studies of many kinds. A short time ago some one asked if any single person had seen all the objects in our great collections. My answer was that the life-time of an individual would not be long enough, as such an inspection carried on at the rate of a reasonable number of specimens per hour for eight hours a day would require more than one hundred years.

I have just indicated that our National Museum in Washington is a national asset in its educational contacts with the entire world, through its exhibition halls open to visitors, through its publications that make available everywhere the results of researches on its vast collections and through the reference collections that are used not only by our own staff but also by the many accredited investigators who come to Washington to study. This university museum that we have come to formally open to-day, equally valuable in proportion to its size, differs in that its field is more directly educational through its definite contact with students. Such a museum with proper support both in finances and interest becomes one of the important factors in the scheme of education of its institution. We are fortunate that Kansas has recognized that fact, one well-known to our present chancellor through his own acquaintance as an undergraduate with our museum halls.

Let me add here that while museums will be developed and expanded so long as our civilization con-

tinues the earlier in their history they receive adequate support the more effective they will become. This is true not only because of the greater facilities that this may afford at the current time but also because in most branches of museum interest many of the most desirable materials become each year more difficult to obtain.

Civilized man is steadily occupying increasing areas of the surface of the earth, and with his occupation come such vast changes from the original condition that natural conformations are destroyed, and hundreds of thousands of individuals of animals and plants and hundreds and thousands of species must disappear. Only those can remain that are sufficiently adaptable to fit into the modified scheme brought by man's presence. Those at all sensitive to change or that require special conditions for their existence inevitably disappear. The next fifty years will offer the last opportunities to secure many forms of nature for preservation for the future. This does not mean that present timely interest in conservation is not worthy of the attention that it receives. I wish merely to indicate that many things of museum interest must be acquired now, as in later years they may be extinct, or may be found only in reserves in such small numbers that none may be taken for museum use lest the entire stock be weakened until it is destroyed. Yearly, therefore, it becomes more and more important, in fact, a duty, to secure such material for the information and study of future generations, while it may be obtained without pressure on the species concerned. Opportunities now neglected may never offer again.

Our own life-time as individuals indicates the meaning of what has just been said. The spread of population here in Kansas is an excellent illustration, since agriculture here has expanded to the exclusion of vast numbers of wild things that formerly ranged within our borders. That all this is right and proper no one will deny, but the effect on much of the wild life of the surrounding region will remain.

We see in the newly opened halls of the Dyche Museum attractive exhibits of many kinds, of mammals, birds, fossils and other objects where the subjects are presented in interesting and often in lifelike manner. The new installations are fascinating and valuable, and we may return to them time after time with friends and relatives or alone to enjoy them and to profit from them to the utmost.

But let me impress upon you the very pertinent fact that these displays, attractive though they may be, are not the most important properties of this museum. The exhibitions once installed may be renovated periodically, but such changes come only at long intervals. While definitely important as educational factors they are in a sense static.

Behind the scenes in this museum, as in the National

Museum in Washington, are rows of cases of study specimens of skins and skeletons of birds and mammals, specimens of reptiles and amphibians, and many other creatures, which are used for the training and study of advanced students and are seen only by such visitors who have special interest in them. These collections, augmented greatly from their early beginnings by the work of Lane, Bunker, Taylor, Hibbard and their assistants, to name only those now here, are known to scientific investigators everywhere. They form a portion of the valuable properties of our university, and constitute in considerable part the dynamic force of this museum. From the investigations concerned in their gathering and study there has come the enthusiasm that has trained dozens of workers in biology who have gone out from the university to make good names in their chosen fields in museums and laboratories throughout this country.

Those who remain in Lawrence may have difficulty in attaining perspective on this point, but to illustrate my meaning it is necessary only to think of the graduates from this university now working in biological or related fields in institutions throughout the United States. Their number and the importance of their work has been constantly evident to me in recent years as administrative duties have claimed more and more of my attention. Their training began here in this museum, and without that early opportunity and inspiration they could not have attained their present status and experience.

Instruction in biology necessarily covers the broader aspects of the subject particularly in the beginning courses, and research in university laboratories on the part of the professors and graduate students, centers often on investigations where there may be developed laws or summations common to large groups of species or to life as a whole. In the enthusiasm that attends this type of investigation we must not forget, however, that in the end we are dealing with species, whether of plants or animals, and that it is a matter of prime importance to us to know the name or names of the groups with which we deal. As our information in physiology, general anatomy and psychology of species other than man increases we find surprising differences in reaction between forms that appear so closely similar superficially, that it may be difficult to those not expert to distinguish them. It is obviously necessary to know the proper identity of these if one is to interpret correctly observations of any kind made upon them. The ecologist is entirely dependent on the proper identification of material for his investigations of animal and plant forms, and studies of individual variation or of chromosomes or of those things included in the science of genetics, whether in kinds of mice or insects, obviously may be misleading if the

material used includes two or more closely related forms that hybridize freely, unless this hybridization is known and understood.

In training in such identifications the University Museum stands in the same relation as the library. The museum laboratories with their study collections are therefore of prime importance in all biological work, not alone in their training of workers who may go out into museums but in the facilities that they offer for basic identifications. The laboratory collections, therefore, that to the uninitiated may appear unattractive, are, nevertheless, a truly dynamic part of the organization. They are the inspiration that leads to understanding of the infinite variety of species that make up our world of living things. Their worth increases as they themselves grow and increase. Let me repeat that, while the exhibition halls of this museum are attractive and instructive, behind the scenes in the laboratory collections there is found a most valuable function and one that continues year after year with steadily growing importance.

During my days as a student in this building we realized that its construction was such that extensive changes would some day be necessary, and finally some years ago it was required that the collections be removed to storage until repairs could be completed. Thanks to the interest of those charged with appropriations this work was made possible, and now finally the great work of installation has been completed. The success of this is evident to all and needs only our admiration. Our thanks must go to those who have done this work so skilfully and so well.

The halls of the Dyche Museum now are open again, but though closed to the public for a period the work that the institution typifies has continued steadily, quietly and unostentatiously behind the scenes. Its training and its opportunities in the kind of science that it concerns have never ceased, though its exhibitions were stored and inaccessible. The spirit of the organization has continued without break.

That the present day is one of difficulty is a fact continually in the minds of all of us. The conflict abroad is now nearer to us than ever before and steadily our own responsibility both individually and as a nation increases. A few days ago a friend in England sent me a bit of shrapnel with the laconic statement that it had fallen on his house the night before. I know this house in the heart of residential London well, and to hold this bit of metal in my hand has brought the terrible conflict now raging over that great city to me with a clarity that no press accounts of the destruction wrought by German bombs can ever equal. Our nation is expending huge sums of money for armament to guard that such terrors may not come

to us here. These entirely necessary expenses mean increased taxes and financial troubles for all, a condition that may continue throughout the rest of our lives.

Support of this great defense program is paramount and essential, but with it let us not forget that in cultural and esthetic pursuits there are not only improvement for the mind and training for the future, but also momentary escape for the individual from the troubles that beset him. In the halls of our museums, our art galleries and our libraries through-

out our great nation there is found enjoyment and recreation for the public to be encountered nowhere else. The contemplation of nature and its laws, and of the individual objects that exemplify these, brings a relief and a peace not elsewhere possible. Public morale, of maximum importance under the grim threats of war, is fostered by such mental relaxation. These are facts to be remembered in periods of stress, that the small financial support for such activities be not denied. Let us consider this as a contribution to the defense armament of the mind and of the soul.

## SOME UNSOLVED PROBLEMS OF THEORETICAL DYNAMICS<sup>1</sup>

By Dr. GEORGE D. BIRKHOFF

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As was first realized about fifty years ago by the great French mathematician, Henri Poincaré, the study of dynamical systems (such as the solar system) leads directly to extraordinarily diverse and important mathematical problems in point-set theory, topology and the theory of functions of real variables.

On the other hand, the abstract point of view emphasized by the foremost American mathematician of the same period, E. H. Moore of the University of Chicago, led him in the early years of the present century to his "general analysis." Moore sought to introduce an absolutely general independent variable, ranging over an abstract space, whereas previously attention had been limited to an independent variable ranging over ordinary  $n$ -dimensional space. He hoped that in this way the abstract essence of various current theories in analysis might be more clearly revealed. Ideas of a somewhat similar type had been proposed a little earlier by Maurice Fréchet and also by Erhard Schmidt. But only Moore saw the full significance of general analysis for mathematical thought; and it is only in recent years that his ideas are receiving the attention which they deserve from mathematicians.

An early illustration of the wide scope of these Moorean ideas was furnished by the "recurrent motions" of dynamical systems first defined and studied by the writer in 1910, shortly after the completion of his graduate studies at Chicago. The possibility of making an extension of this theory so as to define "recurrent motions" and certain analogous "central motions" in the sense of general analysis was announced by him in his Chicago Colloquium Lectures on Dynamical Systems in 1920.

The principal part of his paper was occupied with

this abstract phase of dynamics, which has been the subject of much recent work by American mathematicians and by the powerful contemporary Russian mathematical group. The kind of abstract space,  $R$ , which it seems best to employ is a compact, metric space. Corresponding to the change in "time"  $t$  there is a steady flow of the space  $R$  into itself, each point tracing out a "curve of motion" in  $R$ . The individual points represent "states of motion," and each curve of motion represents a complete motion of the abstract dynamical system. Thus there is provided not only an abstract space  $R$  but a "continuous group":  $G: t' = t + c$ . In other cases this group may be discrete:  $t' = t + n$  ( $n$ , an integer), or of still more complicated form. For a continuous flow in such an abstract space  $R$ , the recurrent motions are merely those which trace out with uniform closeness in any sufficiently large period of their entire history, all their states; a periodic motion, represented by a closed streamline, affords the simplest illustration of such a recurrent motion. The analogous central motions are those which recur infinitely often near to any particular state of the motion, or at least have such motions in the infinitesimal vicinity of any state.

The first ten of the sixteen problems presented and briefly discussed were of this abstract type.

Problem 1 embodied a conjecture as to the inter-relationship between continuous and discrete flows in such an abstract space  $R$ . It is easy to see that this relationship must be an intimate one by recalling the close connection between an ordinary changing visual image of continuous type and the corresponding moving-picture image of discrete type. In the abstract space  $R$  a species of reduction of a continuous flow to a discrete flow or at least one of "extensibly discrete" type may be effected by a process of sectioning,

<sup>1</sup> Summary of a paper presented at a fiftieth anniversary symposium of the University of Chicago, September 24, 1941.

first employed by Whitney in a local manner. It was conjectured that conversely any such extensively discrete flow may be imbedded in an ordinary continuous flow. Ambrose and Kakutani have recently obtained interesting results lying in the same general direction as this first problem.

In problems 2 and 3 it was conjectured that *all* the motions of a continuous flow will be recurrent if and only if the flow may be decomposed into a set of irreducible constituent flows which are "homogeneous" (*i.e.*, such that the stream lines are topologically indistinguishable from one another). Thus the familiar two-body problem for a sufficiently small value of the energy constant is of this type, the irreducible constituents being the individual periodic elliptic motions.

The flows which arise from ordinary dynamical problems are not only continuous but in general are "conservative," *i.e.*, leave a volume integral invariant, as in the case of the flow of an incompressible fluid. This property of conservativeness was used about seventy-five years ago by Boltzmann and Maxwell in the foundation of statistical mechanics. It is easy and natural to extend the definition of conservative flows to the abstract case. Important studies of abstract conservative flows have been made recently by Bebutoff, Bogoliuboff, Kryloff, Stepanoff in Russia and by Halmos, Oxtoby, Ulam, von Neumann, Wiener and Wintner in this country, among others. The field of mathematics devoted to the study of conservative flows has risen to the rank of an important branch of mathematics, called "ergodic theory." This theory is destined to play a fundamental role in statistical mechanics, although as yet its importance for this field has not been generally realized by physicists.

Problem 4 was concerned with such conservative abstract flows. Here the interesting conjecture was advanced that at least if the abstract flow is so regular as to be "geodesic," then it will be conservative if all the motions are central. The converse fact was essentially established by Poincaré in the third volume of his "Méthodes Nouvelles de la Mécanique Céleste."

The reasonableness of this conjecture was based upon the use of a modified type of "compressibility volume" of the kind introduced by E. Hopf, and an analysis of recent remarkable results of Denjoy which established the unexpected fact in a simple special case that the *ultimate* behavior of a dynamical system may depend on the degree of regularity of the functions which characterize it.

In problem 5 it was likewise conjectured that the recurrent motions are necessarily everywhere densely distributed in the space  $R$  of a conservative flow. Poincaré has made an analogous but stronger conjecture in the case of the restricted problem of three bodies and of certain analogous problems when  $R$  is

a three-dimensional space, namely, that the periodic motions are everywhere dense in the totality of motions, but it is known that his conjecture does not always hold. Questions of this general type are of philosophical interest, since the crude speculation that all dynamical systems are periodic or nearly so presents itself irresistibly to the human mind.

It was emphasized that from another point of view the real significance of the conservativeness of a flow is that (almost) all motions have *habitual modes of behavior in the mean with respect to any measurable process*. For example, consider the idealized frictionless motion of a billiard ball on a billiard table which has the shape of a convex oval. In any such motion the ball will be in the long run a definite proportion of the time on any assigned part of the table, will collide with the rim at a certain definite angular rate, etc. Problem 6 proposed a topological characterization of conservative flows based on this fact, similar to that given by Oxtoby and Ulam, in an as yet unpublished paper.

In problem 7 the restriction of continuity upon a conservative flow was relaxed, and a characterization of the invariants of the flow based on certain "packing coefficients" was proposed. A characterization of certain special types of such flows in terms of their "spectra" has been recently obtained by Halmos, von Neumann, Wiener and Wintner.

Up to this point continuous steady flows in  $R$  and the more special "conservative" type had alone been considered. But the continuity and conservativeness combined do not suffice to characterize the flow of true *dynamical* type except in the simplest case of two dimensions ( $n=2$ ). Hence it is of especial importance to define abstractly a "dynamical" flow. This was attempted by the writer. Roughly speaking, he takes Pfaffian systems as the model for his abstract definition rather than the more familiar but equivalent Hamiltonian systems of classical dynamics. In this way his task becomes that of formulating an abstract equivalent for the variational condition,

$$\delta \int \sum X_i dx_i = 0.$$

The crucial part of his characterization of a dynamical flow lay in the suitable definition of a line integral in any abstract "geodesic space"  $R$ . One conspicuous advantage of such a characterization of a dynamical flow is that the flow in any invariant subspace of  $R$  is seen at once to be of dynamical type also.

It should be emphasized that hitherto the question of the adequate characterization of a dynamical flow beyond the obvious facts of continuity and conservativeness has been especially baffling. The proposed analytic characterization and the conjectured qualitative characterization embodied in problems 8, 9 and 10 should prove suggestive in this connection. In

problem 8 it was asserted that a dynamical flow is necessarily conservative; in problems 9 and 10 that, certain cases aside, not only are the periodic motions everywhere dense but *the stable periodic motions are everywhere dense and dense on themselves*. Here a stable periodic motion was defined purely topologically as any periodic motion in whose infinitesimal vicinity lie other complete motions. A partial converse is known to hold through results obtained by D. C. Lewis and the lecturer.

Problem 11 was of a nature intermediate between the case of an abstract space  $R$  and a space  $R_n$  of  $n$  dimensions, and was the only problem not stated in complete form. It called for the appropriate generalization to a gas of certain remarkable results for the famous three-body problem due to Sundman, and extended by the writer and Hinrichsen to  $n > 3$  bodies and to a more general law of force than that of Newton.

Problem 12 called for an example to show that in the case of a continuous (non-conservative) flow in a space  $R_n$  of  $n \geq 3$  dimensions, the ordinal series of "wandering motions" leading to the central motions need not always terminate in  $n$  or fewer steps.

In problem 13 it was conjectured that essentially the only 3-dimensional discrete flows which are "regular" in the sense of Kerékjártó are (1) combined rotations of three circles into themselves; (2) combined rotations of circle and surface of a 3-sphere into themselves; (3) rigid rotation of a 3-dimensional hypersphere into itself.

Problems 14 and 15 were closely related. The first of these asserts that a 1-1 direct analytic area-preserving deformation of the surface of a sphere into itself which has two fixpoints, and is such that iterates of the transformation have no other fixpoints, is a pure rotation from a topological point of view. Considerable evidence was adduced for this conjecture. The second problem embodied an analogous conjecture concerning a plane circular ring.

The last two of the announced problems (problems 16, 17) will perhaps excite the most interest, since

they embody conjectures which in a certain sense yield a kind of complement to the famous "last geometric theorem" of Poincaré, announced as probably true by Poincaré shortly before his death and established subsequently by the lecturer. Suppose that there be given a ring-shaped part of the plane bounded by two concentric circles. Suppose that this ring is deformed into itself in any way so that the areas of small figures are conserved, while the points on the two circles are advanced by angular distances  $\alpha$  and  $\beta$ . If  $\alpha$  and  $\beta$  are distinct, Poincaré's theorem leads at once to the conclusion that there are infinitely many periodic sets of points under the indefinite repetition of this deformation. But if  $\alpha$  and  $\beta$  are equal, his theorem is not applicable. The conjecture was made that the same result (as well as other more specific ones) will hold in the case  $\alpha = \beta$ , provided that some nearby points of the ring become separated widely in an angular sense by sufficient repetition of the deformation, as clearly happens when  $\alpha$  and  $\beta$  are unequal. This conjecture was proved in the very important special case when the given conservative deformation can be expressed as the product of two involutonic deformations.

In consequence, for the classic restricted problem of three bodies treated by the American astronomer G. W. Hill, so long as there exists a "surface of section," either there exist infinitely many periodic motions (for a given value of the "constant of Jacobi") or all possible motions of the "infinitesimal body" (the Moon in the Earth, Moon, Sun case) will necessarily have the same mean rate of synodical advance of perigee about the near-by finite body (the Earth), per synodical revolution. It was also pointed out how the absence of infinitely many periodic orbits would indicate that a new *qualitative* integral exists, in addition to the usual analytic integral of Jacobi.

The problems presented and discussed by the writer will be likely to receive attentive consideration from other mathematicians inasmuch as they embody challenging conjectures concerning important open questions in the actively advancing field of theoretical dynamics.

## OBITUARY

### ELMER SAMUEL IMES

IN the death of Elmer Samuel Imes science loses a valuable physicist, an inspiring personality and a man cultured in many fields.

Professor Imes was born on October 12, 1883, in Memphis, Tennessee, the son of Home Missionary parents. His father, Benjamin A. Imes, a graduate of Oberlin College and Theological Seminary, was among the pioneers in educational and church work

in the southern field of the American Missionary Association.

Imes taught for many years in the American Missionary schools, principally in Albany Normal School, Albany, Georgia, before he pursued his ultimate and highest interest, the field of physics and its educational and commercial adaptations.

He was graduated from Fisk University in 1903, and did graduate study both there and in the Uni-

versity of Michigan, from which institution he received his Ph.D. degree, his thesis having to do with infra-red spectra, a subject on which he has acquired an international reputation. Prior and subsequent to receiving his degree he was a research and consulting engineer and physicist. For ten years, ending on his death on September 11, 1941, he was professor of physics and head of the department of physics at Fisk University, Nashville, Tennessee, where he created a highly efficient organization.

He leaves a mother, Mrs. Elizabeth W. Imes, and two brothers, Albert L. Imes, of Cincinnati, Ohio, and the Reverend William Lloyd Imes, pastor of St. James Presbyterian Church, New York City.

It was the writer's privilege to become acquainted with Professor Imes in his graduate student days at the University of Michigan, where his research laboratory was a mecca for those who sought an atmosphere of calm and contentment. Peacefully smoking his pipe, Imes could always be relied upon to bring to any discussion an atmosphere of philosophic soundness and levelheaded practicalness. Gifted, moreover, with a poetic disposition, he was widely read in literature, and a discriminating and ardent appreciator of music. He had a delightful sense of humor and a skill in repartee, which he always used, however, with the kindness and consideration so characteristic of his sensitive nature. In his passing, his many friends mourn the loss of a distinguished scholar and a fine gentleman.

W. F. G. SWANN

BARTOL RESEARCH FOUNDATION  
OF THE FRANKLIN INSTITUTE,  
SWARTHMORE, PA.

#### MAX KRISS 1894-1941

PENNSYLVANIA STATE COLLEGE lost one of its leading scientists as Dr. Max Kriss died from coronary embolism on November 16 after an illness of two weeks.

During twenty-three years as a member of the staff of the Institute of Animal Nutrition, Dr. Kriss became one of the world's leading authorities on the energy metabolism and ventilation requirements of domestic animals, the net energy values of feeding stuffs and the influence of nutrient compounds, especially amino acids, on the heat production of animals.

Born on May 15, 1894, at Ostropol, Russia, the son of Joseph Kriss, a scribe, and his wife Fannie, Max Kriss came to the United States in 1910. He earned his own way through Pennsylvania State College by labor and by teaching Russian and Hebrew. Being graduated in 1918, he became a member of the staff of the Institute of Animal Nutrition under the direc-

tion of Dr. Henry Prentiss Armsby, and at the time of his death held the rank of professor of animal nutrition.

At Pennsylvania State College, Kriss received the degree of master of science in 1920, and at Yale University the degree of doctor of philosophy in 1936.

He was the author or co-author of more than 50 scientific papers dealing with animal nutrition. Always a modest, kindly and charitable gentleman he gave great pleasure to his associates during discussions of scientific problems because of his fair and scholarly disposition.

He leaves a wife and one son, Joseph, who is a student at Yale University School of Medicine.

E. B. FORBES

PENNSYLVANIA STATE COLLEGE

#### DEATHS AND MEMORIALS

DR. ELSIE CLEWS PARSONS, president of the American Anthropological Association, died on December 19. She was sixty-six years old.

PROFESSOR ROLLIN LANDIS CHARLES, head of the department of physics at Franklin and Marshall College since 1922, died on December 13 at the age of fifty-six years.

DR. PAUL HENRY HANUS, professor emeritus of education at Harvard University, died on December 14 at the age of eighty-six years. An important advance was made in 1891 when Dr. Hanus was appointed assistant professor of education at Harvard University through the influence of President Eliot.

DR. FRANK CONRAD, assistant chief engineer of the Westinghouse Electric and Manufacturing Company of Pittsburgh, died on December 11 at the age of sixty-seven years.

DR. VLADIMIR J. FEWKES, archeologist, research associate of the museum of the University of Pennsylvania, died on December 11 in his forty-sixth year.

A BUST of the late Dr. William H. Nichols, donor of the Nichols Chemistry Building of New York University, acting chancellor of the university in 1929, was unveiled at an informal ceremony in the Nichols Building on December 19. The bust was given to the university by Mrs. Madeline Sharp, daughter of Dr. Nichols, and was accepted by Dr. John P. Simmons, director of the Nichols Laboratory. Other speakers were Dr. Harry Lindwall, chairman of the department of chemistry of the University College of Arts and Pure Science; Dr. Henry J. Masson, chairman of the department of chemical engineering of the College of Engineering, and Dean Thorndike Saville, of the College of Engineering.

## SCIENTIFIC EVENTS

### THE ADVISORY BOARD ON SANITARY AND PUBLIC HEALTH ENGINEERING

MEMBERS of the National Technological Civil Protection Committee, appointed by the Secretary of War in January, 1941, have agreed to act also as an Advisory Board on Sanitary and Public Health Engineering to the Medical Division of the Office of Civilian Defense. The committee, which represents the major engineering and related societies, includes:

Walter D. Binger, New York, American Society of Civil Engineers, *chairman*.

W. H. Carrier, Syracuse, N. Y., American Society of Heating and Ventilating Engineers.

Frederick G. Frost, New York, American Institute of Architects.

E. M. Hastings, Richmond, Virginia, American Railway Engineering Association.

Harry E. Jordan, New York, American Water Works Association.

W. Cullen Morris, New York, American Gas Association.

John C. Parker, New York, American Institute of Electrical Engineers.

Arthur B. Ray, New York, American Institute of Chemical Engineers.

Scott Turner, New York, American Institute of Mining and Metallurgical Engineers.

James L. Walsh, New York, American Society of Mechanical Engineers.

Abel Wolman, Baltimore, American Public Health Association.

The Office of Civilian Defense will have a contact member on this committee, as does the War Department. Ralph E. Tarbett, senior sanitary engineer, U. S. Public Health Service, who has been assigned as chief sanitary engineer of the Medical Division of the Office of Civilian Defense with headquarters in the Washington office, will be the contact member.

Regional sanitary engineers are being appointed by the Medical Division of the Office of Civilian Defense to work through state defense councils with state health departments in planning defense against belligerent action. Most important of their immediate duties will be to promote development of protective measures for public water supplies, which may be subject to destructive enemy action. The engineers will also consult with health authorities on such matters as emergency maintenance of sewerage, sanitary facilities, garbage disposal, protection of food and milk supplies in the event of a disaster.

Two regional sanitary engineers are already on duty. Gordon E. McCallum, sanitary engineer, U. S. Public Health Service, has been commissioned in the

Public Health Service Reserve and assigned to the Third Civilian Defense Region (Pennsylvania, Maryland, District of Columbia and Virginia) plus West Virginia and Ohio. Mr. McCallum is stationed in Washington. John H. Brewster, at various times sanitary engineer for the American Waterworks and Electric Company and for the New York and Indiana state health departments and recently a private consultant in Troy, New York, has also been appointed a sanitary engineer in the Reserve of the Public Health Service and assigned to the First and Second Regions (New York, New Jersey, Delaware and the New England states).

### RESEARCH GRANTS OF THE VIRGINIA ACADEMY OF SCIENCE

DR. FRANK A. GELDARD, professor of psychology at the University of Virginia and chairman of the Virginia Academy of Science Research Committee, has announced that the following scientific workers in the state have been awarded research grants to aid them in their investigative work. The recipients are:

Margaret Altmann, of Hampton Institute, for a study of basal temperature curves of ten Negro women students during the sex cycle; Aaron Appleby, of the Virginia Polytechnic Institute, for his work in trying to find a calcium compound better suited than calcium gluconate for administering calcium ions to animals; Thomas A. S. Hayes, of the Virginia Polytechnic Institute, for a survey of the prevalence and importance of the large-mouth bowel worm in sheep in Virginia; H. W. Jackson, of the Virginia Polytechnic Institute, for the construction of an improved electrical machine for temporarily stunning fish, the determination of the exact composition of the fish population of a given area being often an important guide in the management of a pond; A. Margarite Risley, of Randolph-Macon Woman's College, to help her in an investigation in astronomy; Robert W. Root, C. Lane Sarter, N. C. Steenland, Robert O. Wilbur and H. H. Woods, senior students at Washington and Lee University, for a detailed study of the geology of the area immediately around Lexington; Frances A. Schofield, of Randolph-Macon Woman's College, to complete a study having to do with biochemistry, and J. C. Strickland, of the University of Virginia, to help him to complete a collection of the blue-green algae of the state.

Members of the Academy Research Committee besides Dr. Geldard are Dr. F. C. Vilbrandt, of the Virginia Polytechnic Institute, and Dr. Gillie Larew, of Randolph-Macon Woman's College. Dr. Ivey F. Lewis, of the University of Virginia; Dr. Rolland J. Main, of the Medical College of Virginia, with the officers of the academy; Dr. George W. Jeffers, of Farmville State Teachers College; Dr. E. C. L. Miller

and Dr. Sidney S. Negus, of the Medical College of Virginia, are *ex-officio* members.

Dean Earle B. Norris, of the Virginia Polytechnic Institute, has been invited by the committee of the academy to make a study on its behalf of research needs and research facilities in Virginia with special reference to cooperation between science and industry.

### THE AMERICAN CHEMICAL SOCIETY

DR. PER K. FROLICH, director of the Chemical Division of the Esso Laboratories of the Standard Oil Development Company at Elizabeth, N. J., known for his work in the development of synthetic rubber, has been elected president of the American Chemical Society for 1943.

Dr. Frolich will take office as president-elect on January 1, when Dr. Harry N. Holmes, head of the department of chemistry at Oberlin College, becomes president, succeeding Professor William Lloyd Evans, head of the department of chemistry at the Ohio State University.

The election was made by the council from the four nominees receiving the largest number of votes in a mail ballot of the 29,000 members. The council includes national officers, directors, editors of the publications of the society, chairmen of eighteen professional divisions, councilors from the ninety-four local sections and councilors-at-large.

Professor Arthur J. Hill, of Yale University, and Dr. E. R. Weidlein, director of the Mellon Institute of Industrial Research, Pittsburgh, were chosen directors. Dr. Charles Allen Thomas, director of the Thomas and Hochwalt Laboratories, Dayton, Ohio, research division of the Monsanto Chemical Company, was named director-at-large.

New councilors-at-large are Dr. George D. Beal, assistant director of the Mellon Institute of Industrial Research; Dr. Gustav Egloff, director of research of Universal Oil Products Company, Chicago, Ill.; Professor Henry Gilman, of Iowa State College, and Professor Carl S. Marvel, of the University of Illinois.

The official statement reads:

In addition to his contributions to the development of synthetic rubber, Dr. Frolich is best known for his work on transformation and chemical utilization of hydrocarbons, high-pressure gas reactions, catalysis and applied colloid chemistry.

At the one hundredth national meeting of the American Chemical Society in Detroit on September 9, 1940, Dr. Frolich and his research associates presented the first technical report on the discovery of butyl rubber, made from petroleum. The new process climaxed ten years of cooperative efforts by the Standard Oil research, development and management units carried on entirely independently of any other synthetic rubber development either in this country or abroad.

Dr. Frolich was born in Christiansand, Norway, in 1899,

and was graduated from the Norwegian Institute of Technology in 1921. He received the degree of master of science from the Massachusetts Institute of Technology in 1923, and the degree of doctor of science from the same institution in 1925.

Dr. Frolich was assistant chemist at the Norway Institute of Technology from 1919 to 1921, instructor at Christiansand Business College from 1921 to 1922, and American-Scandinavian Foundation Fellow at the Massachusetts Institute of Technology during 1922-1923. Dr. Frolich served as assistant in the Massachusetts Institute of Technology Research Laboratory of Applied Chemistry from 1925 to 1927. He became assistant director of the laboratory in 1927 and was advanced to associate professor in 1929, the year he joined the staff of the Standard Oil Development Company.

Dr. Frolich is the author of many technical papers and has been granted numerous patents. He has long been active in the American Chemical Society, serving as chairman of the Division of Petroleum Chemistry, chairman of the North Jersey Section, councilor-at-large, and associate editor of *Chemical Reviews*. He was awarded the Grasselli Medal in 1930 for outstanding achievement in chemistry, particularly in the field of high pressure reaction of gases.

### THE MEETING OF MATHEMATICIANS AT LEHIGH UNIVERSITY

THE forty-eighth annual meeting of the American Mathematical Society will be held at Lehigh University, Bethlehem, Pa., from Monday to Wednesday, December 29-31, in conjunction with meetings of the Mathematical Association of America, the Association for Symbolic Logic and the National Council of Teachers of Mathematics.

The sessions of the society, all of which will be held in the Packard Laboratory, will begin on Monday at 2 P.M. and continue through Wednesday afternoon. The sessions of the Mathematical Association will be held on Thursday morning and afternoon. On Wednesday afternoon, the Association for Symbolic Logic will hold meetings, one of which will be a joint session with a section of the society. The National Council will meet on Wednesday and Thursday.

The board of trustees will meet at 6 P.M., on Monday, and the council at 8 P.M., on Tuesday.

A symposium on applied mathematics will be held on Tuesday afternoon. The program will consist of two addresses, "The Mathematical Theory of Traveling Waves," by Professor L. V. Bewley, and "Some New Methods of Solution of Two-Dimensional Problems in Elasticity" by Professor I. S. Sokolnikoff, and discussions by Professors Alan Hazeltine, Ernst Weber, D. L. Holl and J. L. Synge.

On Tuesday, at 4 P.M., tea for visiting mathematicians and guests will be served in Drown Hall by the ladies of the Department of Mathematics of Lehigh University.

The annual business meeting and election of officers will be held on Wednesday morning. At this time the award of the Frank Nelson Cole Prize in Theory of Numbers will be announced, and the recipient will give a brief talk on the paper for which the prize is awarded. Following this, Professor Oscar Zariski will give an address entitled "Normal Varieties and Birational Correspondences."

The joint dinner (informal) for the four organizations will be held at the Hotel Bethlehem on Wednesday, December 31, at 8 P.M., followed by a New Year's Eve party which will continue until midnight, and will include a number of musical and entertainment features suitable to the occasion.

There will be a luncheon for members of Pi Mu Epsilon on Thursday.

### THE DALLAS MEETING OF THE AMERICAN ASSOCIATION

THE American Association for the Advancement of Science and its Associated Societies meet next week at Dallas, Texas. A full preliminary announcement of the program by the permanent secretary, Dr. F. R. Moulton, will be found in the issues of SCIENCE for November 28 and December 5.

The Executive Committee of the Council meets on Sunday, December 28, and the council meets on the afternoon of Monday. The Academy Conference will be held on the adjournment of the council; the Secretaries Conference, beginning with a dinner, will be held on Wednesday. The annual Science Exhibition will be held in the Baker Hotel from Monday to Thursday, inclusive.

At the first general session of the association on Monday, Dr. Albert F. Blakeslee, of the Station of Experimental Evolution of the Carnegie Institution, will give the address of the retiring president entitled "Individuality and Science."

Three other general sessions will be held. On Tuesday, Dr. Edwin P. Hubble, astronomer of the Mt. Wilson Observatory of the Carnegie Institution, will give the annual lecture under the joint auspices of Sigma Xi and the association. On Wednesday evening at five o'clock the seventh annual Pi Kappa Phi lecture will be given by Dr. Rufus B. Von Klein Smid, president of the University of Southern California; the seventh Phi Beta Kappa address will be given in the evening by Dean Christian Gauss, of Princeton University.

During the week, each of the fifteen sections and the Sub-sections of Dentistry and Pharmacy will hold meetings addressed by the chairmen, who are vice-presidents of the association. There will be numerous meetings of thirty affiliated and associated societies.

The association had in 1900 about twelve hundred members. In that year SCIENCE was made the official journal, and the membership increased rapidly. When the association met in New Orleans in 1905 there were 4,321 members and 211 papers were read. There are now over 22,000 members. It is expected that at Dallas about fifteen hundred papers will be presented. In spite of war conditions it is hoped that the meeting will be of special interest and will demonstrate the fundamental importance of science for the national welfare.

## SCIENTIFIC NOTES AND NEWS

REAR ADMIRAL RICHARD E. BYRD has named a coastline area of the Antarctic Continent extending to a thousand miles "Hobbs Land" in honor of Professor William H. Hobbs, emeritus professor of geology at the University of Michigan. Hobbs Land includes the area formerly known as Ruppert Land, the Ruppert name having been given to a cape.

THE Edison Medal for 1941 has been awarded by the American Institute of Electrical Engineers to Dr. John Boswell Whitehead, director of the school of engineering of the Johns Hopkins University, "for his contributions to the field of electrical engineering, his pioneering and development in the field of dielectric research, and his achievements in the advancement of engineering education."

THE Institute for Aeronautical Sciences has awarded the Octave Chanute Award for 1941 to Melvin N. Gough, senior test pilot for the National Com-

mittee for Aeronautics Laboratories at Langley Field, Va., in recognition of "his fundamental aeronautical researches conducted on airplanes in actual flight."

SIR HENRY DALE, director of the National Institute for Medical Research, London, and president of the Royal Society, was presented with the Gold Medal of the Royal Society of Medicine at a recent meeting of the council. The medal is awarded every three years "for valuable contributions to the science and art of medicine."

DR. FRANCIS PEYTON ROUS, of the Rockefeller Institute for Medical Research, has been elected an honorary fellow of Trinity Hall, Cambridge. Dr. Rous holds the honorary degree of Sc.D. from Cambridge and was Linaere lecturer at the university in 1929.

DR. JOHN E. WEEKS, professor of ophthalmology emeritus, of the New York University College of Med-

icine, was guest of honor at a dinner given on October 6 attended by eighty friends and students.

DR. M. G. MELLON, professor of analytical chemistry at Purdue University, has been elected president of the Indiana Academy of Science.

DR. ALFRED H. WHITE, chairman of the department of chemical and metallurgical engineering at the University of Michigan, has resigned, his resignation to take effect at the end of the present semester. He will remain in the department as professor of chemical engineering. Dr. George Granger Brown has been appointed his successor.

DR. MARSHALL SCHALK has resigned as assistant geologist in the Pittsburgh office of the Gulf Oil Corporation in order to become assistant professor of geology and geography at Smith College.

DR. HOWARD A. MEYERHOFF, professor of geology and geography at Smith College, has been appointed by Governor Saltonstall a member of the Massachusetts Committee on Public Safety to serve as regional director for the region that includes seventy-two towns in Hampshire, Hampden and Franklin Counties and six towns in Worcester County.

DR. F. C. BARTLETT, professor of experimental psychology in the University of Cambridge, has been appointed a member of the British Medical Research Council to succeed the late Professor A. J. Clark.

MAURICE HOLLAND, for eighteen years director of the Division of Engineering and Industrial Research of the National Research Council, has been appointed research adviser to the Pillsbury Flour Mills Company, Minneapolis.

THE *News Edition* of the American Chemical Society states that G. J. Callister, formerly vice-president of the American Potash Institute, has been appointed for the duration of the war general secretary of the Canadian Society of Technical Agriculturalists, Ottawa.

DR. NATHAN W. SHOCK, formerly research associate, Institute of Child Welfare, and assistant professor of physiology, Medical School, University of California, has been appointed senior psychophysiological in the National Institute of Health, U. S. Public Health Service. He will be in charge of the experimental program of the unit on gerontology of the institute, which has established a laboratory in the Baltimore City Hospitals.

THE Hoffman Scholarship of the Chemists' Club has been awarded for the year 1941-1942 to Robert T. Olsen, a candidate for the Ph.D. degree in the department of chemistry at the Massachusetts Institute of Technology. His Ph.D. dissertation will be in the

field of syntheses of coumarones. This scholarship, founded by the late Dr. William F. Hoffman, is available in alternate years; the stipend is \$800.

DR. T. DALLING, professor of animal pathology at the University of Cambridge, has retired to become the director of the British Ministry of Agriculture's Veterinary Laboratory at Weybridge.

DR. ZING-YANG KUO, director of the Institute of Physiology and Psychology at Chungking, is visiting England at the request of the Minister of Education for China and by invitation of the Universities' China Committee in London.

*Nature* reports that Bjorn Helland-Hansen, the hydrographer, head of the Meteorological Institute of Bergen, was arrested some six months ago and is still in prison.

DR. ROBERT D. GILLESPIE, London, chief psychiatrist of the British Royal Air Force, delivered on November 30 the ninth Weir Mitchell Oration of the College of Physicians of Philadelphia. His topic was "Psychoneuroses in Peace and War and the Future of Human Relationships."

DR. J. J. GALLOWAY, professor of geology at Indiana University, spent the week of October 27 to 31 as visiting lecturer in the department of geology at Smith College. On October 27 he gave a general college lecture on "Ancient Rulers of the Earth," and during the week conducted a series of seminars within the department on the following subjects: Opportunities for Women in Geology, Geologic Fallacies, Origin of Petroleum, Biologic Principles in Paleontology, Major Trends in Foraminiferal Evolution.

THE Herzstein Lectures, given in alternate years under the auspices of the School of Medicine of Stanford University and the Medical School of the University of California, will be given by Professor E. Braun-Menendez, of the Physiological Institute of the University of Buenos Aires. He will speak on March 9, 11 and 13 on "Experimental Renal Hypertension." The Morris Herzstein Lectures were established in 1929, under a provision of the will of the late Dr. Morris Herzstein, of San Francisco.

AN Associated Press dispatch states that the University of Leyden, founded in 1575, will be closed in answer to a student strike which protested against the dismissal of a Jewish professor.

A DIRECTORY of schools of agriculture in Latin America, the first publication of its kind, has been completed by the U. S. Office of Education. The publication lists by countries 182 institutions and 38 experiment stations.

SEVENTEEN physicians, specialists in various fields

in medicine, arrived recently in New York. They have been sent by the Government of Chile for a four-month course of study in American hospitals.

THE Australian government has under consideration the establishment of a National Medical Service to provide free medical treatment for every one. To put the plan into effect the expenditure of \$17,000,000 will be required, and the estimated annual cost is expected to be \$22,000,000.

*The British Medical Journal* states that the Pavlov laboratories in Leningrad are conducting research on the effect of various pharmaceutical substitutes on the higher nervous system. The work is going on regularly and systematically despite the proximity to the front.

THE American Society for X-ray and Electron Diffraction will meet at Boston on December 31. In the morning a joint session will be held with the Mineralogical Society of America in the Hotel Statler.

THE fiftieth anniversary of the founding of Drexel Institute of Technology, Philadelphia, was celebrated on December 17 at the Founder's Day ceremonies held in the college auditorium, followed by the traditional students' Christmas exercises. Members of the Drexel family, educators from neighboring colleges and schools, members of the Drexel board of trustees, and the entire faculty and student body of the college attended to pay tribute to the memory of Anthony Joseph Drexel, the Philadelphia financier and philanthropist, who founded the college in 1891. President Parke R. Kolbe presided at the exercises.

A SPECIAL tuition-free defense course, designed to train radio technicians, is being conducted at New York University. The course, subsidized by the U. S. Office of Education, is open to twenty-five selected high-school graduates with a background of physics, chemistry and mathematics. It began on November 10 and will continue for nineteen weeks.

ACCORDING to the *Journal* of the American Medical Association, the Chicago Cancer Committee, Inc., has been organized as a liaison educational agency; Dr. Ludvig Hektoen, executive director of the National Advisory Cancer Council, is chairman. The purpose is to disseminate information on the symptoms, diagnosis, treatment and prevention of cancer, to aid indigent cancer patients to obtain treatment and to work toward the establishment of hospital and other necessary facilities. Dr. William F. Petersen, chairman of the board of governors of the Institute of Medicine of Chicago, is treasurer of the committee; the directors include Dr. John A. Wolfer, chairman of the cancer committee of the Illinois State Medical Society; Dr. Bowman C. Crowell, associate director

of the American College of Surgeons; Mrs. Arthur I. Edison, state commander of the Women's Field Army of the American Society for the Control of Cancer, and Alexander Ropehan, director of the health division, Council of Social Agencies, secretary.

THE department of medicine of the Medical School of the University of California has instituted a course on the cyclotron and its products. This course is probably the first of its kind given for a large group of medical men. Instructors are members of the staff of the Radiation Laboratory of the University of California in Berkeley, of which Dr. Ernest O. Lawrence is director. Development of the cyclotron in medical and biological research has been under the direction of Dr. John H. Lawrence, assistant professor of medicine in the Medical School, and a brother of Dr. Lawrence.

It has been the practice for professional societies in the various fields to encourage students of these professions to participate in the work of the societies, while still in college. The Institute of Radio Engineers recently took a step in this direction by appointing representatives at sixty-five educational institutions. These representatives are authorized to use the name of the institute in connection with activities carried on by student members, with the cooperation or under the supervision of the institute representative.

ACCORDING to the *Journal* of the American Medical Association the national government of Ecuador, aided by grants from the Rockefeller Foundation, has established a National Institute of Hygiene in Guayaquil as a part of the national department of health. A building has already been constructed by the government, and the Rockefeller Foundation will provide funds for equipment and contribute to the salaries of the personnel and to the general expenses. The foundation will continue its support on a decreasing scale for five years until the government takes over full responsibility. It will also provide fellowships for the training of personnel. The first director will be Dr. Atilio Macchiavello of Chile, who will hold the position for two years to complete the organization. Dr. Juan A. Montalván, a member of the staff of the health department, will then become the director. Dr. Montalván is now in the United States in training for the position. There will be departments of tropical pathology, bacteriology and immunology, epidemiology, pathology and diagnosis, chemistry and food analysis, control of biologic products, production of biologic products and a number of general services. The Rockefeller Foundation has granted fellowships for the present year to José Crusellas Ventura, who is to take charge of the department of chemistry and

food analysis, and to Dr. V. Mosquera Ferrés, who will be director of the department of pathology and diagnosis.

THE Trustees of Oberlin College recently awarded contracts for the construction of a Physics Laboratory. This is one unit of a proposed science quadrangle. A second unit, a Biology Laboratory, is in early prospect. The structural steel for both units was purchased some months ago and is on the ground. The quadrangle will be "anchored" to the present Chemistry Laboratory, chemistry being the only science at present in permanent quarters. On July 22 President Wilkins and Professor Taylor shared the ceremony of breaking ground for the physics unit, the construction of which is now under way. The laboratory will cover a space  $59 \times 194$  feet and will consist of two floors and basement. The estimated cost of the building and its furnishings is \$390,000. The architect is Edward J. Schulte, of Cincinnati. Besides unusually thorough provisions, designed under the direction of Professor C. E. Howe, for electrical distribution to student positions throughout the laboratory, this unit will house a well-equipped instru-

ment shop, including glass-blowing facilities, serving all the science departments of the college.

CONDITIONS in Russia prevented the attendance of any Russian delegates at the International Congress of Genetics held in Edinburgh in August, 1939. According to *The Journal of Heredity* up to the last minute it was expected that there would be a considerable Russian delegation at the congress. The papers or abstracts submitted by the Russian delegates were on file with the Secretariat of the congress at the time it was held. Since these papers were not read by the authors they were not included in the proceedings, which have recently been published. It is the wish of many of the Russian workers that these papers somehow be made available as a matter of permanent record. The papers dealing with *Drosophila* are being issued by the *Drosophila* Information Service and thus will be available. Through the instrumentality of the American Documentation Institute the other contributions are being afforded supplemental publication so that genetic workers can obtain them as microfilms or as photo-prints.

## DISCUSSION

### MEAN SEA-LEVEL AND SAND MOVEMENTS

A RELATION between mean sea-level and the height of sand along the pier at the Scripps Institution of Oceanography at La Jolla, Calif., was shown by La Fond.<sup>1</sup> He stated: "It should not be concluded that the rise in sea-level alone causes a building up of the sand, but many of the factors which influence the sea-level must likewise affect the sand movements." The conclusion that the rise in sea-level in any way causes the change in sand level can not be sustained; however, the factors which cause the changes in sea-level likewise change the shore-line shape so that a retreat or advance of the mean high-tide line (used for convenient reference only) will appear as a depth change along a fixed reference line, such as the La Jolla pier, where accurate measurements of position are easily made.

Fig. 1 shows the height of mean sea-level on the La Jolla tide staff, and the average height of the sand at fifty equally spaced stations along the pier. The data of La Fond are not included; the additional data were furnished by Dr. H. U. Sverdrup, director of Scripps Institution of Oceanography.

The flow of water past a headland projecting into the stream will induce an eddy current to form in the bight in the lee of the headland, causing the shore-line to take the form of a logarithmic spiral.<sup>2</sup> When sea-level is high along the Pacific Coast of the United

States, it is low along the South American coast, necessitating an interchange of water between the hemispheres. Upwelling and prevailing winds also influence currents.<sup>3</sup>

The shore-line shapes resulting from current reversals will then be similar to those shown in Figs. 2A and 2B; when those two forms are superimposed, as in Fig. 2C, the retreat and advance of the high-water lines become apparent. La Jolla is situated in a position similar to the area marked "X." Had simultaneous observations been taken at position "Z," an increase in the sand height would have been noted during the fall in the sea-level height, while in the vicinity of "Y" no change in sand height would have been found, other than minor oscillations. This can be shown more easily by a survey of the shore-line in the bight during March and another in September, accurately locating a particular contour near the high-water line.

The seasonal travel of sand between the rocky headlands which form the California coast has long been observed, although no adequate explanation has been given. However, competent observers have noted the summer and winter oscillations and have concluded that but little sand passes the headlands, the quantity on each section of beach remaining approximately constant, recognizing that stream additions of sand occur in some bights and wind denudations in others. This view is reached by examination of the rock

<sup>1</sup> Eugena La Fond, *SCIENCE*, July 29, 1938.

<sup>2</sup> Harry Leyboldt, *Shore and Beach*, January, 1941.

<sup>3</sup> *Ibid.*, *U. S. Naval Institute Proceedings*, May, 1939.

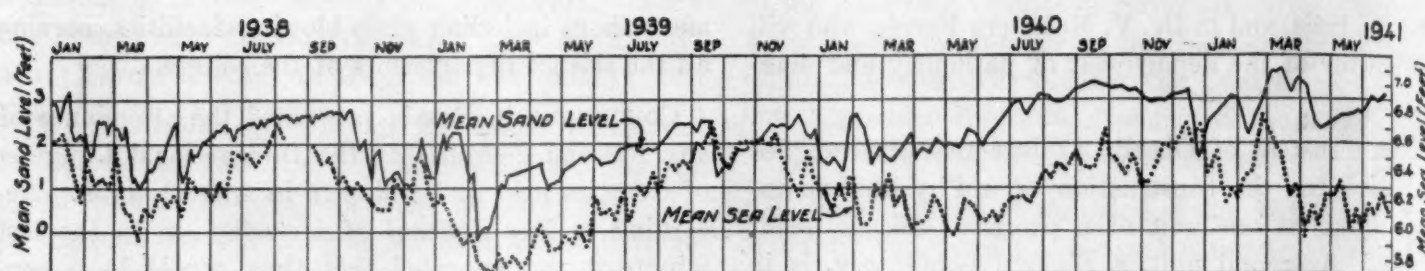


FIG. 1. Relation between mean sea-level on tide staff at La Jolla, California, and mean sand level along Scripps Institution pier, above arbitrary datum.

formations at the headlands. These retain sharp definition. Passage of large quantities of sand in either direction would quickly smooth the rocks. Also, the rocky points are usually heavily covered by kelp beds close inshore which grow on roots firmly anchored to a rocky bottom, precluding the possibility of sandy bottom at these points, therefore the passage of sand thereover.

The shorter periodical reversals of currents, caused by upwelling, winds and tides, also will move the shore-line to and fro, with the resulting change in sand height, accounting for the shorter period changes. Grant and Shepard<sup>4</sup> discussed the data of La Fond and others but reached the erroneous conclusion that the sand moved "onshore and offshore by waves of oscillation when they get into shallow water." They also stated: "During the winter stormy period the material is shifted out from the foreshore and deposited on the sea floor along the outer portion of the pier. In the summer the material creeps back to the foreshore." No attempt is made to explain this bizarre action of the sand "creeping back to the foreshore in the summer" or how an offshore component sufficient to carry sand offshore for a thousand feet

<sup>4</sup> U. S. Grant and F. P. Shepard, *Proceedings of the Sixth Pacific Science Congress*, 1939.

or more is introduced into the waves of oscillation, practically all of which approach the beach from seaward. Similarly vague was the discussion of the current reversal cause.

"Observations at the Scripps pier show that a current ranging up to 2,000 feet per hour runs along the shore. This current frequently reverses its direction because of local conditions" (italics mine).

The effort to explain the phenomenon by introducing undiscovered and probably non-existent forces which cause a sand movement on and off-shore (normal to the shore-line), when the well-known lateral sand movements as shown herein amply cover the situation, is unwarranted and unsound.

From the foregoing, it is apparent that the sand height is not a function of the sea-level height. The former is dependent upon the littoral current direction and the shoreline-shaping tendencies of induced eddies, while the current is a function of several factors, one of which is the height of local sea-level in relation to the sea-level height in other portions of the same oceanic basins. Sea-level heights are functions of rainfall in the locality, together with river discharge and other methods of ground-water return, and water removal for rainfall.

The only conclusion which can be drawn from the

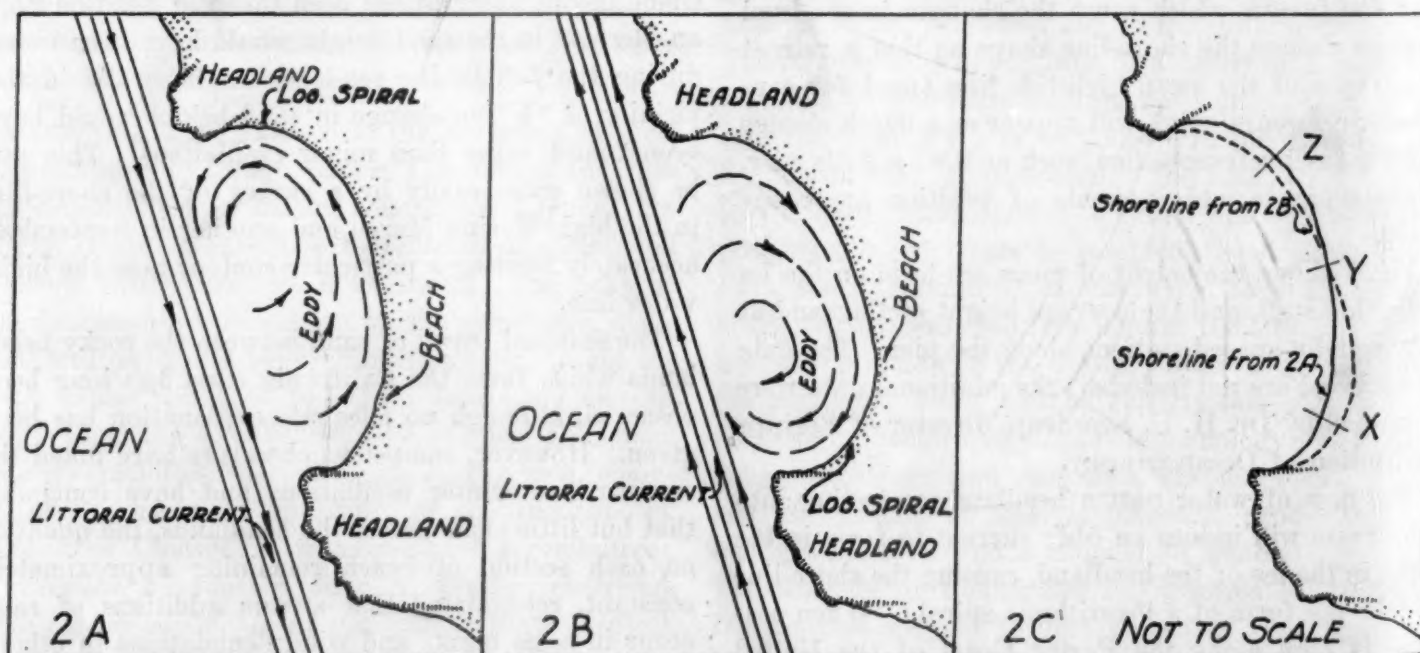


FIG. 2. Shore-line changes from reversal of littoral currents.

sand movements is that a reversal of littoral currents is generally reflected in a consistent change in sea-level height without indicating the relation which probably exists between sea-level and currents.

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### ZIPF'S "LAW OF URBAN CONCENTRATION"

IN the August 15th issue of *SCIENCE*, Alfred J. Lotka points out that the law of urban concentration described by G. K. Zipf in his recent book, "National Unity and Disunity," is not particularly striking and at least not novel, citing a number of cases where the type of frequency distribution utilized by Zipf has been found applicable but where such application has thrown little light upon the relevant functional relationships.

It should also be pointed out that Zipf has attempted to apply the harmonic series frequency law to the frequency distributions of words in English, German, and several other languages.<sup>1</sup> Here, too, Zipf's work was foreshadowed, *viz.*, by E. V. Condon's article, "Statistics of Vocabulary."<sup>2</sup> Though Condon was not able to utilize the empirical data available to Zipf, his mathematical formulation was as adequate as that of Zipf. It is well to note, however, that the harmonic series law has a semblance of good fit to linguistic data only in selected cases—generally where the samples of words are of moderate size (not over, say, 100,000 words) and are taken from written material such as newspapers, books, etc. I have tried without success to apply the law to distributions of words in telephone conversations,<sup>3</sup> in children's speech and in stories written for children.

Finally, I wish to draw attention to a certain mathematical limitation to the application of the harmonic series law. This limitation has been discussed by me previously<sup>4</sup> and can be shown to apply to Zipf's latest contribution. We may first regard the population of an area as analogous to the number of words in a sample ( $N$ ) and the number of cities, towns and villages in an area as analogous to the number of different words in a sample ( $d$ ). We may then write Zipf's law as  $fr^x = \frac{N}{k}$ , where  $f$  denotes frequency (analogously, population of a city, town or village),  $r$  denotes rank, and  $k$  and  $x$  are parameters. As shown in my article, the harmonic series law can not hold for a sample where  $N > dk$ , at least where  $x = 1.00$ .

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<sup>1</sup> "The Psycho-Biology of Language," Boston, 1935.

<sup>2</sup> *SCIENCE*, 67: 300, 1928.

<sup>3</sup> N. R. French, C. W. Carter, Jr., and W. Koenig, Jr., *Bell System Technical Journal*, 9: 290-324, 1930.

<sup>4</sup> J. B. Carroll, *Psychol. Record*, 2: 379-386, 1938.

### "THE BREATHING MECHANISM OF TURTLES"

THE discussion of turtle breathing by Dr. Hansen in a recent issue of *SCIENCE*<sup>1</sup> expresses justifiable impatience with a perpetuation of error by modern textbooks. My reaction to the conflicting statements from different sources about this subject led me in 1939 to start an investigation of turtle respiration using physiological technics. This work is progressing and a report should soon be possible.

It should be pointed out, however, that although the sources quoted by Dr. Hansen—especially the splendid morphological study and deductions of Mitchell and Morehouse, who *appeared* to have settled the question as early as 1863 with little recourse to experimental work—seem to make his own observations a reemphasis of fact from the last century, actually the case is not at rest. Those who talk of throat movements in turtles as breathing action can support their statements by contemporary experimental data. For example, Lüdicke<sup>2</sup> in 1936 appears to arrive at the compromise conclusion that the difference between land turtles (*Testudo*) and aquatic (*Emys*) is that aquatic types swallow air and land types can not. He made observations, like Dr. Hansen's, of cannulized tracheae and collapse of lungs upon opening the body cavity.

My results with an equally aquatic species (*Malaclemys centrata*—diamondback terrapin) do not agree with Lüdicke's. A presentation of experimental evidence and attempts to reconcile conflicting observations can not be done in this comment. I concur in the essential point (but not in his details) of Dr. Hansen's discussion. The primary breathing mechanism in turtles is the movement of muscular diaphragms located at each leg pocket in the shell and ventral to the viscera, together with the muscular closure of the opening in the glottis.

Present writers of text-books who discuss turtle respiration will need to deal with the striking, and misleading, hyoid movements. They appear from records now on hand to be definitely correlated with sensory rather than respiratory functions, and they are almost certainly olfactory.

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### ON THE OCCURRENCE OF STEREOISOMERIC CAROTENOIDS IN NATURE

IT was reported recently<sup>1</sup> that the ripe fruits of the Tangerine tomato (a variety of *Lycopersicum*

<sup>1</sup> Ira B. Hansen, *SCIENCE*, 94: 64, 1941.

<sup>2</sup> M. Lüdicke, *Zool. Jahrb. Abt. Allg. Zool. u. Physiol.*, 56: 83-106, 1936.

<sup>3</sup> L. Zechmeister, A. L. LeRosen, F. W. Went and L. Pauling, *Proc. Nat. Acad. Sciences*, 27: 468, 1941.

*esculentum*) contain a new carotenoid, prolycopene,  $C_{40}H_{56}$ , which on treatment with iodine is rapidly converted into a pigment mixture in which lycopene, the red pigment of the ordinary tomato fruit, predominates. Whereas lycopene possesses the trans configuration throughout, all or most of the double bonds which are available for stereochemical changes are present in their cis form in prolycopene.

Assuming that representatives of the new class of carotenoids are wide-spread in nature, even though their quantity may be small, we tested a series of plant materials in this respect. It was found that a new carotenoid occurs in some palm fruits, viz., *Butia eriospatha* and *B. capitata* (Becc.). It can be crystallized and shows in petroleum ether absorption maxima at 462 and 432.5 m $\mu$ . On addition of some iodine to the solution contained in a spectroscopic cell, the typical three-banded spectrum of  $\gamma$ -carotene appears almost immediately. The maxima are now at

493.5, 461 and 431 m $\mu$ . They have somewhat shorter wave-lengths than pure  $\gamma$ -carotene (495, 461.5 and 433.5 m $\mu$ ) due to the presence of subsidiary stereoisomers. The new pigment has been termed *pro- $\gamma$ -carotene*. In *B. capitata* it is accompanied by prolycopene from which it can easily be separated on the chromatographic column.

The fruits of *Pyracantha angustifolia* (Schneid.) contain pro- $\gamma$ -carotene and at least two different prolycopenes.

Further experiments now in progress in this laboratory may reveal other examples of the occurrence of such carotenoids which are stereochemically different from representatives of the well-known all-trans series.

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## SPECIAL CORRESPONDENCE

### LETTER FROM DOUGLAS COCKERELL, LETCHWORTH, ENGLAND, OCTO- BER 1, TO HIS BROTHER IN COLORADO

THE three-day meeting of the British Association in London has been a notable event. A. Huxley describes it as being the most important scientific meeting ever held. A lot of wise things were said by important people bearing on the function of science in the reconstruction after the war. A sort of "Atlantic charter" for science was promulgated, emphasizing the unity of science throughout the world in spite of racial and political divisions. It was stated that now for the first time we had a provisional standard of the minimum requirement in food to produce the maximum health, and that some three fifths of the people of the world were living below this standard, so we had a very definite aim in front of us. Altogether, as might have been expected from a body of scientists drawn from all over the world, a larger view of world problems was taken than we have had from our politicians.

I have been reading an account of a fanatical sect that existed in the midlands in the early part of the nineteenth century. They were convinced that the end of the world was imminent, and so took no consideration for the future, living from hand to mouth from day to day.

I notice a somewhat similar state of mind developing in connection with the war conditions. The future is so uncertain. I don't think that there is any fear of the country being conquered, but there is great uncertainty about what the conditions will be after the war, particularly about the value of money. People

generally are, I think, in a mood to face and accept great changes if these are ably advocated; wise leadership is what is wanted, and the British Association meeting, by lifting the world problems out of narrow nationalistic grooves, may have a far-reaching effect on world opinion. Anyway it seems to have set a standard to be aimed at, and the political and diplomatic people appeared to agree with the suggestions put forward. The churches, too, are stirring, and taking a much wider view, and there is a marked revival of religious feeling, and a groping for some sort of guidance quite beyond the dogmas of the different sects.

Something great may come out of all this, but at present all seems to be in solution, and what will precipitate out we can not tell.

In the meantime we live on from day to day, not unhappily, but in a fog of uncertainty about the future.

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### POST-GRADUATE COURSE IN TROPICAL MEDICINE AT TULANE UNIVERSITY, 1941-1942

DURING the first half of the academic year 1941-1942 a comprehensive post-graduate course in tropical medicine has been conducted at Tulane University under the auspices of the department of graduate medicine. There are seventeen enrollees, including nine from Latin-America, seven from the United States and one from Canada. Of the Latin-American group two are from Brazil, one from Chile, one from Colombia,

two from Guatemala and three from Mexico. Eight of these nine were selected for fellowship awards of the American Foundation for Tropical Medicine following careful scrutiny of a large group of endorsed applications. Some of the North American physicians in attendance plan to practice in missionary stations in Africa, India and the Netherlands East Indies; others expect to specialize in tropical medicine in the United States or with the defense forces.

The course is carefully integrated and consists of lectures, conferences, quizzes, laboratory, clinic and hospital practice covering the fields of hematology (16 hours), protozoology (40 hours), helminthology (40 hours), medical entomology (40 hours), tropical bacteriology (48 hours), mycology (32 hours), tropical pathology (24 hours), tropical surgery (12 hours), deficiency diseases (24 hours), preventive medicine and public health (24 hours). Approximately 120 of the total of 412 scheduled hours consist of work with patients in the wards of Charity Hospital in New Orleans.

This course is in charge of eight full-time staff members of the Tulane Department of Tropical Medicine, supplemented by time contributed by members of the departments of medicine, surgery, pathology and preventive medicine and public health of Tulane University, as well as of the Louisiana State Department of Health and U. S. Quarantine Service in New Orleans. In addition, the following guest lecturers, specialists in their subjects, have contributed to the success of the course:

Dr. Clarence A. Mills, professor of experimental medicine, University of Cincinnati, "Tropical Climatology" (October 8-10).

Dr. George W. McCoy, director, department of public

health, Louisiana State University Medical School, "Plague and Tularemia" (October 29-30).

Dr. Herbert C. Clark, director, Gorgas Memorial Laboratory, Panama, "Malaria" (November 17-18).

Dr. G. H. Faget, senior surgeon, medical officer in charge, U. S. Marine Hospital, Carville, La., "Leprosy" (November 18-19).

Dr. C. G. Eccles, pathologist, U. S. Marine Hospital, Carville, La., "Pathology of Leprosy" (December 2).

Dr. A. W. Sellards, associate professor of comparative pathology and tropical medicine, Harvard Medical School, "Yellow Fever and Dengue" (November 24-25).

Dr. Rolla E. Dyer, director, division of infectious diseases, National Institute of Health, Bethesda, Md., "Typhus and Tick Fevers" (November 27-28).

Dr. E. B. Vedder, Colonel, M. C., U. S. A. (retired), professor of experimental medicine, the George Washington University, Washington, D. C., "The Deficiency Diseases," "Cholera" (December 8-13).

Dr. E. R. Kellersberger, general secretary, American Mission to Lepers, for twenty-four years missionary physician in the Belgian Congo, "Medical and Human Aspects of African Trypanosomiasis and Leprosy" (December 12).

No academic degree is awarded but a certificate is given to enrollees after successful completion of this work.

With the full endorsement and whole-hearted support of the American Society of Tropical Medicine, the American Academy of Tropical Medicine and other interested groups, it is expected that this course in tropical medicine at Tulane University will become a permanent contribution to American medical education.

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## SCIENTIFIC BOOKS

### GASES

*The Separation of Gases.* By M. RUHEMANN. Oxford University Press, xiii and 279 pages. 1940. \$5.75.

THE importance of natural gases and all the primary gaseous products of industrial processes and the necessity of some degree of gas separation and purification in order that these gases may be used more economically is too well known and appreciated to need comment. The technique and theory of the process of separation of gaseous mixtures, mainly by liquefaction at low temperatures, has developed rapidly in recent years and in other countries—notably Russia—the knowledge and experience acquired by workers in the field have gone far toward establishing low-temperature gas separation as a field of applied science. Moreover, it is claimed that in the near future

all gases used in bulk commercially will probably first be separated, at least partially, into a number of constituents, with a great gain in efficiency. Nevertheless, it is the author's contention that this "deep refrigeration," as it is called, has not received the attention it deserves from physicists, chemists and engineers in this country. It is with the intention of stimulating investigation in this field, and making the information already acquired available in English, that this book was written. While, according to the author's preface, the book is designed, in large degree, for those who may be instrumental in training future workers, it is the reviewer's opinion that the subject matter will appeal mostly to those already engaged as scientists or engineers in industrial laboratories where gas products are an important consideration. However, it must be stated that there is

a great deal which is useful for the production of such low temperatures as may be attained by mechanical means and the book is therefore of interest for research of a more academic nature.

Since the value of a book dealing with a rather specialized subject depends so greatly on the detailed nature of the information presented, the following brief description of contents is given. After a short introduction dealing with general principles involved in gas separation the author reviews in Chapter I the gas mixtures of greatest importance from the industrial point of view. As a preparation for the problems involved in the separation and therefore of primary importance for the design of the separating plant, the equilibrium of vapor-liquid systems (binary and ternary) is treated in Chapter II. While the discussion is presented in an entirely adequate manner some readers will no doubt find it necessary to consult more detailed texts. For instance, although frequent use is made of the phase rule no explicit statement of it is made. This chapter also contains useful equilibrium diagrams for a number of gas mixtures (pp. 44-59). The methods of gas separation and a discussion of the pertinent thermodynamical principles are presented in Chapters III and IV, and in Chapter V refrigeration as applied to gas liquefaction is treated in detail. The remainder of the book is concerned with the separation of special gas mixtures the most important of which is air. Chapters VI to IX are devoted to a discussion of the types of separation plants, the efficiency of various separation methods and the effect of the non-binary character of air, with especial reference to the extraction of rare gases from the atmosphere. The final chapters, X to XII, deal with coke-oven gas, the production of methane and helium and the separation of olefines from cracker gas.

In summary the reviewer feels that this book should be very useful in its field of application and would be more so if greater emphasis had been placed on experimental data.

### ATOMS

*The World and the Atoms.* By C. MOLLER and E. RASMUSSEN, with a foreword by NIELS BOHR. Translated from the second Danish Edition. 193 pages and 40 figures. D. Van Nostrand Company, 1940. \$2.75.

THAT "The World and the Atoms" gives to its readers an admirable account of the fascinating discoveries of modern physics and of the important basic concepts to which they have led is in itself a sufficient recommendation of this most enjoyable book. It is perhaps equally noteworthy that the complementary nature of theory and experiment, so essential for the progress of physical science, is more than adequately expressed. The development of atomic physics starting from the discovery of radium and culminating in the contemporary researches into the atomic nucleus is traced in a very logical and understandable manner—with no mathematics more complicated than multiplication. It is unfortunate that the date of writing prevented more than a brief mention of cosmic radiation.

While no serious fault is to be found with the translator's version the substitution of *brass* for *messing* (facing page 78), *sodium* for *natrium* (Fig. 14) and *tungsten* for *wolfram* (Fig. 21) would have been preferable. Fig. 27 contains a misprint in that the last element of the radioactive chain pictured should be an isotope of *lead* and is therefore *stable* rather than *stabbe*.

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## SPECIAL ARTICLES

### THE PROTECTION OF MICE AGAINST INFECTION WITH AIR-BORNE INFLUENZA VIRUS BY MEANS OF PROPYLENE GLYCOL VAPOR

SINCE our earlier report on the germicidal action of certain glycols dispersed as fine droplets (aerosols),<sup>1</sup> we have found that the vapors of these compounds exert a rapid and highly bactericidal effect on air-suspended bacteria.<sup>2</sup> Our studies show that the

<sup>1</sup> O. H. Robertson, E. Bigg, B. F. Miller and Z. Baker, *SCIENCE*, 93: 213, 1941.

<sup>2</sup> O. H. Robertson, E. Bigg, B. F. Miller, Z. Baker and T. T. Puck, *Transactions of Assoc. of Amer. Physicians*. In press.

lethal action of glycol aerosols is due principally to the liberation of gas by rapid evaporation of the aerosol droplets. When employed in the gaseous form the amounts of glycol required for effective air sterilization are much smaller than when the substance is introduced as an aerosol. Continued accumulation of evidence indicates that propylene glycol is the agent of choice for this method of killing air-borne bacteria because of its high bactericidal activity and low toxicity for the body as compared with other glycols.

In order to test the action of propylene glycol vapor on influenza virus it was first necessary to devise a simple and effective means of recovering this virus

from the air. The only data we have found in the literature on this subject are in a paper by Andrewes and co-workers,<sup>3</sup> in which a very brief statement was made to the effect that by the use of bactericidal mists, presumably NaOCl, they found that a few viruses, including influenza, were susceptible to the mist action as judged by their reduced infectivity for mice. No mention was made of the method of testing. Since the most direct and convincing method of determining the antiviral effect of propylene glycol vapor would be protection against air-borne infection, experiments were undertaken toward that end. That spontaneous experimental infection with influenza virus from infected to normal animals does occur by the aerial route has been shown by Andrewes and Glover<sup>4</sup> in experiments with ferrets. Eaton's<sup>5</sup> observation that normal mice may contract influenza from close contact with infected mice provides suggestive though not conclusive evidence for droplet infection.

Our experiments consisted in exposing 5 to 10 gram mice in a 60 liter glass-walled chamber to mouse-adapted influenza virus<sup>6</sup> (the PR8 strain of Francis<sup>7</sup>) in the form of a fine mist produced with a Graeser atomizer.<sup>8</sup> The virus, consisting of dilutions of finely ground infected mouse lungs suspended in broth containing 20 per cent. normal horse serum, was sprayed into the chamber in quantities of 0.2 to 1 cc. The mice were exposed to the virus mist for periods of time ranging from 5 minutes to 1 hour. Exposure of several hundred mice to sprays of  $10^{-2}$  dilution of the virus resulted regularly in extensive consolidation of the lungs and death within 4 to 10 days. Less numerous tests with higher dilutions of virus have shown that pulmonary lesions are produced constantly with amounts as small as  $10^{-4}$  but not all the animals succumb to the infection at this dilution. Still higher dilutions produced pulmonary lesions occasionally, but no deaths.

Experiments on the protective action of propylene glycol vapor were carried out as follows: Mice were placed in a chamber into which propylene glycol vapor was introduced in concentrations of 1 gram of propylene glycol to two to three million cc of air.<sup>9</sup> Then 0.2 to 1 cc of a  $10^{-2}$  dilution of the virus was sprayed into the chamber and the mice exposed for periods of 15 minutes to 1 hour. All these animals remained

well, whereas the control mice similarly exposed to the same suspension of influenza virus alone died within 4 to 10 days of influenza and showed extensive consolidation of the lungs from which the virus was recovered. In other experiments the test mice were killed after 6 to 8 days to determine whether they had been completely protected against infection. A protocol of one such test is shown in Table 1. In this

TABLE 1  
PROTECTIVE ACTION OF PROPYLENE GLYCOL VAPOR

	Amount of virus sprayed into chambers	Result
32 mice in chamber containing glycol vapor 1:2,000,000	0.39 cc $10^{-2}$ dilution	All remained well; killed 8th day; lungs normal*
35 mice in control chamber	0.37 cc $10^{-2}$ dilution	All died 6-10 days with extensive consolidation of lungs

\* One mouse showed a small area of consolidation about one mm in diameter in the left upper lobe.

particular experiment the mice were shielded from the spray during the introduction of the virus. They were kept in the chambers for 30 minutes. The fact that mice in the propylene glycol atmosphere were exposed in many instances directly to the influenza virus spray, yet failed to contract infection suggests that the interaction between vapor and virus droplets is exceedingly rapid and may approach the rate at which the glycol vapor kills bacteria suspended in air.<sup>10</sup>

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BARTLETT MEMORIAL FUND,  
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#### PROPERTIES OF THE ISOLATED MACROMOLECULAR COMPONENT OF NORMAL CHICK EMBRYO TISSUE<sup>1</sup>

STUDIES on the ultracentrifugal isolation of the equine encephalomyelitis virus<sup>2</sup> revealed the presence

<sup>10</sup> When these experiments had been largely completed, the senior author received a manuscript by Drs. Werner Henle and Joseph Zellat, in which they reported the protection of mice against air-borne influenza virus by means of propylene glycol aerosol. These authors adapted the technique previously described by us (SCIENCE, 93: 213, 1941) to their particular experiments with the virus.

<sup>1</sup> This work was aided by the Dorothy Beard Research Fund and by a grant from Lederle Laboratories, Inc., Pearl River, N. Y.

<sup>3</sup> C. H. Andrewes, *Lancet*, 2: 770, 1940.

<sup>4</sup> C. H. Andrewes and R. E. Glover, *Brit. Jour. Exp. Path.*, 22: 91, 1941.

<sup>5</sup> M. D. Eaton, *Jour. Bact.*, 39: 229, 1940.

<sup>6</sup> We are indebted to Dr. Thomas Francis, Jr., and Dr. Frank Horsfall, Jr., for supplying us with this strain of virus. Their methods for preparation of the virus suspensions have been used in these experiments.

<sup>7</sup> T. Francis, Jr., *SCIENCE*, 80: 457, 1934.

<sup>8</sup> J. B. Graeser and A. H. Rowe, *Jour. Allergy*, 6: 415, 1935.

<sup>9</sup> The methods employed will be described in detail in a subsequent publication.

in diseased chick embryo tissue of two heavy components, one with a sedimentation constant of  $S_{20} = \text{ca } 250 \times 10^{-13} \text{ cm sec}^{-1} \text{ dynes}^{-1}$  and the second with a sedimentation constant of  $S_{20} = \text{ca } 70 \times 10^{-13} \text{ cm sec}^{-1} \text{ dynes}^{-1}$ . The former is present only in diseased tissue, while a component similar to the latter is found also in normal chick embryo tissue.<sup>3</sup> In the earlier experiments both components obtained from diseased tissue appeared equally infectious. Subsequent experiments have indicated that the heavier material with  $S_{20} = 253 \times 10^{-13} \text{ cm sec}^{-1} \text{ dynes}^{-1}$  represents the equine encephalomyelitis virus.<sup>4</sup> However, in order to eliminate the possibility of some relation between the virus complex and the lighter component of diseased tissue, systematic studies have been made of the properties and the behavior of the latter.

Since infectivity of the lighter material from diseased embryos could have been due to contamination<sup>2</sup> with small quantities of the virus complex, a better separation was sought by changes in the isolation technique. This has been accomplished by the extraction with distilled water of diseased embryo tissue for 42 to 96 hours without adjustment of pH. The extracts, filtered through celite, were then subjected to two or three cycles of alternate low- and high-speed centrifugation at 17,000 g and 67,000 g for 15 and 30 minutes, respectively. Distilled water was the solvent throughout, the pH remaining between 7.2 to 7.4. The significant changes were: (1) prolonged extraction (42 to 96 hours as compared with two hours previously used); (2) pH (7.2 to 7.4 instead of 8.5 to 9.0) and (3) filtration with celite.

The procedure yields a product entirely different with respect to infectivity from that previously reported. While infectivity is practically always associated with the material, the infectious unit has been  $10^{-8.5}$  grams or greater, a difference of the order of 100,000 or more in comparison with the unit of the virus complex, which is consistently  $10^{-13}$  to  $10^{-14}$  grams.<sup>2</sup> These findings substantiate the suspicion of previous imperfect separation of the two components. Studies on the nature and properties of the lighter component indicate that it is in no way related to the virus complex.

Solutions containing 1 mg or more of the lighter

component from diseased or normal tissue per cc are opalescent and, in the higher concentrations, exhibit a distinct yellow cast. The material is precipitated by the usual protein coagulants and gives positive xanthoproteic, Millon and biuret tests, but a negative glyoxylic acid test. The Molisch test is negative, while that for pentose with Bial's reagent and the acrolein test for fat are strongly positive. Heat coagulation occurs at 73 to 76° C. The yield has varied from 1 to 4 mg per gram of embryo tissue. The ultraviolet absorption spectrum showed a maximum at 2600 Å.

Analysis of 440 mg of the substance, dialyzed against distilled water and dried from the frozen state and further dried to constant weight over  $\text{P}_2\text{O}_5$ , revealed an elementary constitution of C, 55.2; H, 8.3; N, 9.5; P, 2.3; and S, 0.22 per cent. Extraction successively with acetone, alcohol-ether (1-1) and benzene revealed a fat content of 34.6 per cent. of which phospholipid constituted 67.0; cholesterol, 18.4; and fatty acid 20 per cent. The total carbohydrate of the whole complex was 7.0 per cent. The partial specific volume by pycnometer measurement was 0.79, corresponding to a specific gravity of 1.27.

Fractionation of 181 mg of the lipoid-free fraction for nucleic acid yielded 28.5 mg of a white amorphous product giving a positive Bial's test but negative Feulgen and diphenylamine tests. The biuret test was negative. On hydrolysis crystalline adenine picrate was isolated, and the murexide test for guanine was positive. Tests for cytosine or uracil or both were positive. The test for thymine was entirely negative. This ribonucleic acid represented 10.5 per cent. of the whole complex, and the ultraviolet absorption curve was indistinguishable from that obtained with yeast nucleic acid.

Ultracentrifugal sedimentation diagrams of the undamaged material reveal sharp boundaries indicative of high homogeneity, comparable in this respect to the papilloma virus protein<sup>5</sup> and the equine encephalomyelitis virus complex.<sup>6</sup> The sedimentation constant at pH 7.0 in water is  $S_{20} = 73 \times 10^{-13} \text{ cm sec}^{-1} \text{ dynes}^{-1}$  and in borate buffer solution at the same pH  $S_{20} = 78.7 \times 10^{-13} \text{ cm sec}^{-1} \text{ dynes}^{-1}$ . Molecular stability studied in 0.005 M buffer solution by means of the analytical ultracentrifuge was at a maximum between pH 7.0 and 8.2, precipitation occurring at pH 4.8, degradation above pH 8.3 to smaller relatively homogeneous fragments. The complex is extremely salt labile, breaking down in three or four days even in 0.005 M salt solutions.

Comparison of the properties of the lighter com-

<sup>2</sup> A. R. Taylor, D. G. Sharp, H. Finkelstein and J. W. Beard, *Proc. Soc. Exp. Biol. and Med.*, 42: 462, 1939.

<sup>3</sup> D. G. Sharp, A. R. Taylor, H. Finkelstein and J. W. Beard, *Proc. Soc. Exp. Biol. and Med.*, 42: 459, 1939. It should be emphasized that this component is wholly different from the normal chick embryo component of Claude (*Proc. Soc. Exp. Biol. and Med.*, 39: 398, 1938) reported (K. G. Stern and F. Duran-Reynals, *SCIENCE*, 89: 609, 1939) to have a sedimentation constant of  $S_{20} = \text{ca } 532 \times 10^{-13} \text{ cm sec}^{-1} \text{ dynes}^{-1}$ .

<sup>4</sup> D. G. Sharp, A. R. Taylor, D. Beard, H. Finkelstein and J. W. Beard, *SCIENCE*, 92: 359, 1940.

<sup>5</sup> J. W. Beard, W. R. Bryan and R. W. G. Wyckoff, *Jour. Infect. Dis.*, 65: 43, 1939.

<sup>6</sup> A. R. Taylor, D. G. Sharp and J. W. Beard, *Jour. Infect. Dis.*, 67: 59, 1940.

ponent with those of the virus complex<sup>4,6</sup> reveals pronounced differences. Further, in the degradation of the virus complex by any means yet studied, no material with  $S_{20}^0 = ca\ 70 \times 10^{-13}$  cm sec<sup>-1</sup> dynes<sup>-1</sup> has been seen. It appears reasonable to conclude that the lighter component in diseased embryo tissue is identical with that of normal chick embryo tissue and as such is not specifically concerned with the disease process associated with the virus.

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### CRYSTALLINE CATALASE FROM BEEF ERYTHROCYTES

As early as 1911 Wolff and de Stoecklin<sup>1</sup> obtained rather highly purified catalase solutions from erythrocytes (species not stated). In 1923 Tsuchihashi<sup>2</sup> described a method for the purification of the horse erythrocyte catalase.

In our laboratory Tria<sup>3</sup> made considerable progress in purifying the catalase of beef blood, and recently A. L. Dounce<sup>4</sup> obtained this catalase in crystalline condition. But Dounce's method is time-consuming and the yield is very small.

We have prepared crystalline catalase from washed and laked cow erythrocytes by the following steps:

1. Adsorption on aluminum hydroxide<sup>5</sup> at pH 5.7, repeated washing of the adsorption complex with dilute acetate buffer pH 5.5, and elution with M/10 phosphate buffer at pH 8.0.

2. Precipitation at pH 5.7 with 30 gm ammonium sulfate for every 100 cc of enzyme solution. This

precipitation was then repeated, using one tenth of the initial volume.

3. Dialysis, followed by precipitation at pH 5.5 by enough alcohol to make 40 per cent. concentration.

4. Solution in 1.25 per cent. NaCl and adsorption at pH 5.5 on Al(OH)<sub>3</sub> followed by elution with phosphate buffer pH 8.0 (no preliminary washing).

5. Precipitation of the eluted catalase with 30 gm of solid ammonium sulfate per 100 cc, at pH 5.7. The precipitate is mixed with a minute amount of water, centrifuged and allowed to stand in the ice-chest. Crystals form. The yield is increased by adding saturated ammonium sulfate slowly.

The catalase obtained by this method had a "Kat.f" of 43,000 and the crystals had the shape of small needles. After a second recrystallization from ammonium sulfate solution the crystals were mostly plates, while the "Kat.f." was 48,000. The iron content was 0.12 per cent. The visible absorption spectrum is identical with that for liver catalase.

Unlike crystalline beef liver catalase, erythrocyte catalase gives no blue color upon treatment with acetone and hydrochloric acid, but a reddish-brown color. The reddish-brown material has been identified as hemin.

These preliminary findings indicate that beef erythrocyte catalase differs from beef liver catalase in possessing a greater activity and in lacking prosthetic groups which furnish the "blue substance" or biliverin.

One of us (M. L.) wishes to express his sincere gratitude to the Rockefeller Foundation for both the material and moral support.

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## SCIENTIFIC APPARATUS AND LABORATORY METHODS

### A GRINDER FOR HOMOGENIZING BACTERIAL CLUMPS OR INFECTED TISSUES

THE problem of preparing homogeneous suspensions of acid-fast bacteria, infected tissues or small amounts of various substances in the laboratory has long since resulted in the production of various grinders to facilitate the process. Recently, the need arose for a considerable supply of sterile grinding devices for homogenization of leprosy nodules to recover the bacilli. It was found that remarkably com-

plete homogenization and suspension of subcutaneous nodules, after they were cut down to small pieces by means of scissors, could be brought about in Pyrex grinders of the type illustrated in Fig. 1.

The important features in the construction of such grinders are: (a) selection of pairs of tubes so that one fits closely within the other, (b) careful boring of the holes in the rubber stoppers which join the inner grinding tube to the glass-shaft, and (c) grinding of the paired tubes with emery powder in water to produce roughened surfaces which rotate against each other without letting the small bits of tissue lodge where they may escape grinding. Due to the type of joint used, the inner grinding tube never rotates perfectly on its axis, but has a wobble which causes it to scour the walls of the outer tube. The rotating shaft

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<sup>1</sup> J. Wolff and E. de Stoecklin, *Compt. Rend. Acad. Sci.*, 152: 729, 1911.

<sup>2</sup> M. Tsuchihashi, *Biochem. Zeitschr.*, 140: 63, 1923.

<sup>3</sup> E. Tria, unpublished.

<sup>4</sup> A. L. Dounce, unpublished.

<sup>5</sup> G. Tracey and W. H. Welker, *Jour. Biol. Chem.*, 22: 55, 1915.

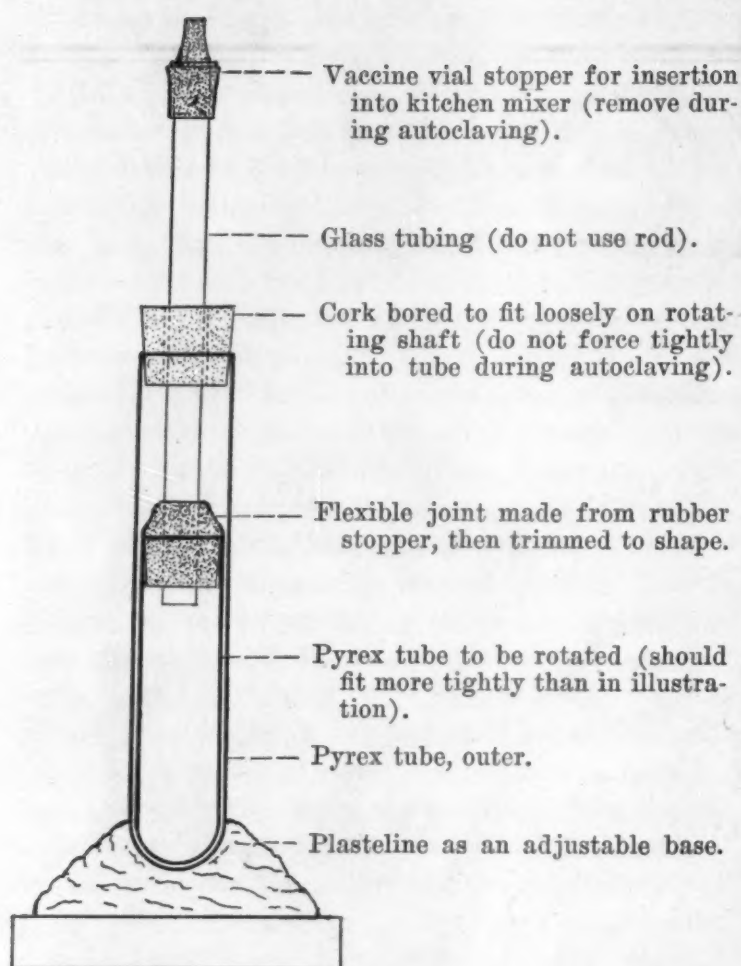


FIG. 1. Grinding Device ( $\frac{1}{2}$  natural size). The outer tube is plugged with cotton and sterilized separately to facilitate loading with cultures or tissues. The inner tube assembly is sterilized in a full-length test tube and transferred into the outer tube aseptically when the materials are ready for grinding. Since each pair of inner and outer tubes is ground together, the tubes are given the same number to prevent accidental interchanges.

is hollow to permit expansion of gases during autoclaving, which should be done with the small rubber cap removed. A standard kitchen mixer is used to rotate the grinding tube, but the terminal fittings for this tube can readily be adapted to any source of power. The size of the tubes and the relative length of the inner tube can be varied to suit almost any amount of material.

Due to the large grinding surfaces, the diluting fluids can be added rapidly by simply sliding the sterile cork up the shaft, rotating at low speed while fluid is added, and then giving a final brief spin while the inner tube is raised and lowered in the outer one a few times. Removal of the inner tube and substitution of sterile stoppers into the flared mouth of the outer tube permits ready access to the suspensions.

The amount of silica liberated through the abrasive action of the two grinding tubes varies with the conditions of operation. If the two tubes are separated by water only, they produce suspensions of silica which are fine enough to remain in virtually complete

suspension for considerable periods of time. When cultures of acid-fast bacteria are being ground to a smooth paste, the tubes are lubricated by the bacteria and do not liberate perceptible amounts of silica. The amount that is liberated in the grinding of tissues is influenced by the amount of tissue (more tissue, less silica) and by the period of grinding. Best results are obtained with just enough fluid or material to fill the space between the tubes. For some purposes silica suspensions may be desired and for others they must be guarded against.

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### DENATURATION OF EGG ALBUMIN BY PRESSURE

BRIDGMAN'S<sup>1</sup> observation that the white of egg becomes coagulated by high hydrostatic pressure suggested that egg albumin is denatured by pressure. Late in 1939 and early in 1940 the writers made a preliminary study of the subject of the exposure of -SH linkages by high pressures to verify the effects of denaturation by pressure.

Twenty grams of Merek's impalpable powdered egg albumin were dissolved in 500 milliliters of water and the mixture dialyzed under toluene, filtered four times through a filter cell, twice through filter-paper and stored finally under toluene. Ten cc samples were subjected to pressures ranging from 1,000 to 7,500 kg/cm<sup>2</sup>, the samples being submerged under sterile mineral oil in the pressure chamber to separate from the pressure transmitting liquid. In every case the solutions were coagulated by the pressure treatment, the amount of coagulation becoming more copious the higher the pressure.

The exposure of -SH linkages was verified in two ways after the pressure treatment. Using the 2-6 dichlorophenolindophenol dye in the manner of Todrick and Walker<sup>2</sup> it was observed that the bleaching effect increased with the magnitude of the pressure used for the treatments. Some of the tests were made using the Kassel and Brand<sup>3</sup> modification of Folin and Marenzi's<sup>4</sup> technique. These also showed exposure of -SH groups. Circumstances did not permit further quantitative study of these interesting preliminary observations.

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<sup>1</sup> P. W. Bridgman, *Jour. Biol. Chem.*, 19: 511, 1914.

<sup>2</sup> Todrick and Walker, *Biochem. Jour.*, 31: 292, 1937.

<sup>3</sup> Kassel and Brand, *Jour. Biol. Chem.*, 125: 115, 1938.

<sup>4</sup> Folin and Marenzi, *Jour. Biol. Chem.*, 83: 103, 1929.

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## SCIENCE NEWS

*Science Service, Washington, D. C.*

## SOIL EROSION

DR. W. C. LOWDERMILK, of the U. S. Soil Conservation Service, in an address before the opening session of the American Association for the Advancement of Science, pointed out that North Africa and the Near East, scourged for the thousandth time by war, have suffered even more during intervals of peace than from the havoc of actual armed strife. Partly because of war-caused paralysis of civil life, partly from internal disorder and weakness, soil-conserving practices begun by good farmers ages ago have been permitted to fall into disuse, and the impoverished soil has eroded to bedrock.

The world's earliest large-scale civilizations, in the Tigris-Euphrates and Nile valleys, have had diverse histories, Dr. Lowdermilk pointed out. The history of the land now called Iraq has had marked ups and downs. This is at least partly due to the fact that its agriculture depended on irrigation canals, which were at times permitted to silt up and become useless. For the past thousand years or more, the valley that was once the Garden of Eden has been in a "down" phase of its history, impoverished, underpopulated.

Egypt, on the other hand, has depended on the annual Nile flood for its irrigation, so that its only problems have been much simpler ones of drainage, to prevent the water table from becoming too high and to eliminate saline deposits from certain spots in the soil.

Apparently the device of terracing sloping fields was first used by the ancient Phoenicians, in the fields on the mainland back of Tyre and Sidon. As the necessities of the growing city populations pressed ever harder on the means of support, the stone-supported terraces were pushed ever higher up the hills. If the work had to be done at present-day wages the cost would be very high. Nevertheless, these ancient terraces have justified their existence. Where they have been well taken care of they are still functioning, after more than 2,000 years of use. Where they have been neglected and allowed to break down, the soil has slid into the valleys and choked the rivers, leaving the rock sticking out of the hillsides.

Dr. Lowdermilk drew a lesson for America from the history of these classic lands. Here, too, there has been neglect and wastefulness in land use, and soil erosion has started at an alarming rate.

However, the speaker concluded, "this destructive force did not go unheeded. Far-sighted students of land foresaw the dangers of soil erosion. But it was not until experimental studies were begun by which it was possible to measure comparative losses of water and of soil under various types of cropping, slopes and climates, that the magnitude of the menace could be measured. On the basis of these researches, a nation-wide program of demonstration projects in erosion control and soil conservation showed the farmer and the technician alike how this enemy of civilization might be controlled. Out of these steps has grown a movement for conservation of land resources which was founded upon the lessons of the past and science of the present. Continued progress in

this movement of conservation must be founded on the adaptation of the findings of research to problems in land use that become more and more intricate as the demands upon the land increase."

## RENEWABLE RESOURCES

LIVE on income, not capital; use renewable resources, rather than exhaust non-renewable ones. Such is the national policy that was urged by Dr. H. L. Shantz, of the U. S. Forest Service, in an address before the meeting of the American Association.

The nation's resources were divided by Dr. Shantz into two categories, renewable and non-renewable. The latter are of mainly mineral origin. Some, notably the metals, last a long time and can be reworked several times before they vanish out of circulation. Others, especially coal, oil, natural gas and fertilizer deposits like phosphates and potash, are completely expended the first time they are used. Non-renewable also, the speaker pointed out, are species of plants and animals: once exterminated, they can never return.

Renewable resources include water power, plant products and animal uses of plant products. These came back in cycles; every year in annual crops, over longer periods in forest products, perennial in water power. These are the things that should be used most freely, and should be substituted for non-renewable resources where that can be done, as in the use of plastics instead of metals.

The soil occupies an intermediate position. If it is permitted to waste itself through erosion, it is strictly a non-renewable resource. If it is properly conserved, it moves into the renewable category.

Dr. Shantz pointed out that "Plant cover is most important as a source of energy and as a means for holding the soil. When this cover is gone, it becomes almost impossible to hold the soil. It is doubtful if plowlands can endure permanently, but where there is a closed cover of vegetation the soil is permanently safe."

## THE TOTAL SOLAR ECLIPSE

WITH Soviet Russia involved in a major war, it seems likely that the next total eclipse of the sun will not be nearly as well observed as if that nation had remained at peace.

The eclipse will occur on September 21, when the tip of the moon's shadow will touch earth in southern Russia, east of the Caspian Sea. Then it will sweep eastward, over the Sea of Aral, in southern Siberia, China, including the cities of Hankow and Nanchang, the northern tip of Formosa and the other of the southern Japanese Islands, and over the Marianna Islands, of which American-owned Guam is southernmost.

In preparation for the event, the Soviet Academy of Sciences last year set up a commission, with V. Fesenko as chairman, to plan the observations. As a result an elaborate program was evolved, with some 200 observers scheduled to operate from 16 different observing points, the most favorable being in the mountains of Kazakhstan.

At its longest, the sun will be covered by the moon for about 2½ minutes.

Subjects for study during the eclipse period were to be: the Einstein theory; the sun's corona, best observed at eclipse time; its innermost atmospheric layer; the chromosphere; the sudden explosions in the sun that seem to cause electrical and magnetic disturbances on earth and the zodiacal light, a glowing band sometimes seen near the sun. In addition to ground parties, some observations have been planned from airplanes and stratosphere balloons, which would rise above possible clouds.

Now that the Soviet Union is so vitally concerned with defense from Hitler's attack, it seems quite likely that the efforts of her scientific men which would have been expended on the eclipse may be diverted. On the other hand, since some preparations have already been made, at least part of the program may be carried out even in wartime. A large booklet of 55 pages, in Russian and English, was issued last year, giving a full account of the problems and numerous technical data about the eclipse. If this has been widely distributed it may help Russian amateurs to make observations even if the professionals can not.

Since the eclipse track traverses China, including much of the occupied region, the Japanese may make some observations from the Asiatic mainland as well as from their islands. Probably no American observations will be made, since Guam, though on the southern edge of the path, is not a suitable location, and it is unlikely that the Japanese, who control the northern islands of this same group, will welcome foreign visitors.—JAMES STOKLEY.

### A NEW SOURCE OF ALUMINUM

A NEW domestic source of aluminum for the United States has been unlocked after years of research and experimentation. Alunite, a white rock usually gray or pink tinted, has long been known as a combined sulfate of potash and alumina. Huge deposits in southern Utah, the largest in the world, were worked during the first World War for potash.

When the United States became self-sufficient for potash from other domestic sources, a practical process to obtain from alunite the material alumina, raw source of all metallic aluminum, was sought. The present source of alumina is bauxite, of which the United States has limited deposits in the South and is mainly dependent on high-grade imports from British and Dutch Guiana.

The U. S. Bureau of Mines recently estimated that there were 13,788,675 tons of pure alunite in Utah, Arizona, Colorado, California, Nevada and Washington, of which Utah has 11,680,000 tons.

Numerous patents have been issued on alunite processes, but all proved impractical in cost competition with bauxite until Kalunite, Inc., of Salt Lake City, after ten years of research and experiments in laboratory and pilot plant conducted by Dr. Arthur Fleischer, developed and patented the new process. This process produces alumina from alunite at a cost of \$35 a ton, which means metallic aluminum at 11.865 cents a pound. This will permit it to compete in cost with Bayer alumina (the process used by the Aluminum Company of America).

Experts report that the metal produced from Kalunite

alumina is equal in grade to that produced from Bayer alumina. There are available in the Marysvale region in Utah at least 3,800,000 tons of ore that can be treated by the Kalunite process for the cost reported. The amount of ore is sufficient to assure a life of at least ten years for a plant producing 200 tons of alumina a day.

The Kalunite method produces alumina by the dilute sulfuric acid process and also produces as a by-product potassium sulfate. In brief, the Kalunite process starts with the long-known method of producing potassium alum and potassium sulfate from alunite. The potassium alum is utilized in order to take advantage of its property of separation by crystallization from solutions.

The alum is then put into an autoclave, which resembles an ordinary kitchen pressure cooker except that greater pressures are used. In the autoclave the normal potassium alum is changed to basic alum which is insoluble in water or dilute sulfuric acid. The alum is then calcined to separate the sulfuric acid from alumina resulting in the non-chemical mixture of alumina and potassium sulfate. The latter is removed by leaching.

### THE NEW VAN GENT COMET

HOPES that the new Van Gent Comet, which is moving into the northern sky after its discovery by an astronomer in Java, will become visible to the naked eye are not to be realized. This is shown by a calculation of the comet's path made by L. E. Cunningham, of the Harvard College Observatory, discoverer of Cunningham's Comet, which did reach naked-eye visibility last winter.

Mr. Cunningham's figures, based on orbital data computed by Dr. F. J. Bobone, at the Argentine National Observatory, showed that in mid-July Van Gent's Comet will pass just below the bright star Arcturus, visible in the southwest in the evening in the constellation of Boötes. Then it will move towards the figure of the Great Bear, and in October will be a short distance below the bowl of the Big Dipper.

At the present time it is approaching the sun, which increases its real brilliance, but it is moving away from the earth, which partly counteracts the rise in brightness. On July 1 it will be about two thirds of the sun's distance from us, or 60,000,000 miles. It will be about 130,000,000 miles distant on September 3, when closest to the sun. After that, it will get closer until December 8, when it will be 74,000,000 miles away, but by that time it will be well outward bound from the sun.

In early September it will appear brightest, when it will reach magnitude 7.5, not enough to be seen with the naked eye, but visible through small telescopes if one knows just where to look.

### "DUST-BOWL" CONDITIONS IN GERMANY

GERMANY seems to have made, in this war, one of the same mistakes we made in the last one, though to be sure on a smaller scale. In 1917, the cry was raised in this country, "Food will win the war!" Western farmers were encouraged to break up grasslands until then unplowed to raise wheat for our associates in the struggle. A few years after the Armistice came drought and dust storms.

An editorial writer in the German conservation journal,

*Natur und Kultur*, laments the draining of swamps and bogs, the clearing of heaths and moors, and the "improvement" of rivers which were undertaken on a wholesale scale after the establishment of Nazi power, as parts of the national campaign for agricultural self-sufficiency. Warning voices were disregarded.

Wasteland clearance was one of the favorite projects of the *Arbeitsdienstkorps*, German equivalent to our Civilian Conservation Corps. They did a Teutonically thorough job of destroying trees and bushes, draining swamps and lowering the water table under wet streamside lands. All this blossomed into grain or hay fields, or truck farms raising vegetables for the cities.

In even shorter time than it took for nature's Nemesis to overtake similar indiscretions in this country, the penalty began to be exacted. German summers since 1938 have had rather pronounced dry spells. The light, peaty soils of the drained swamps have gone with the wind.

To be sure, the areas affected are not great as compared with the one-time Dust Bowl of this country, but in a land of the relatively limited extent of the Reich they loom much larger. Also, the dust storms themselves, reaching heights of only a couple hundred yards, are as nothing compared with our black blizzards, that climbed miles into the air and swept from the Plains to the Atlantic. But again, in a land with so little soil to spare, every lost acre counts heavily.

The evils have already been recognized, Dr. Wetzel states, and steps to remedy them are being taken.

### ITEMS

STARCH has been synthetically made from glucose in the laboratories of the University of California, by Dr. W. Z. Hassid and R. M. McCready. This is the first case on record of the production of starch by any means except the action of plants themselves. The reaction was brought about with the aid of an enzyme known as phosphorylase, which was isolated from potato juice. In its presence, glucose first combined with phosphoric acid (a compound occurring in all green plants) to form a substance called phosphorylated glucose. The enzyme then broke this compound down into its original constituents, glucose and phosphoric acid, and recombined the glucose molecules into starch.

A NEW rot-proofing treatment for fabrics has been invented by Helen M. Robinson, of the Bureau of Home Economics of the U. S. Department of Agriculture. Miss Robinson's process is covered by a public service patent, so that it may be used freely by any one, on a non-exclusive basis. The process consists in immersing the fabric first in a solution of a copper or cadmium salt, then in a solution of morpholine, which is a complex organic compound. The reaction takes place within the fibers of the fabric itself, thoroughly impregnating it and discouraging the growth of mildew and other rot-causing fungi. The goods is stiff at first, but regains its pliability upon drying. Color and texture are not affected.

EXTRACTION from ragweed pollen of a colorless, nitrogen-containing chemical believed to be one of the major causes of hayfever was announced by Professor Harold

A. Abramson and Dr. D. H. Moore, of the Columbia University School of Medicine, and Dr. H. H. Gettner, of Mount Sinai Hospital, at the Wilder D. Baneroff Colloid Symposium held at Cornell University under the auspices of the National Research Council and the American Chemical Society. Professor Abramson reported that the molecular weight of the chemical was found to be "surprisingly low—only 5,000." This small size is significant, it appears, from his explanation that in order to produce hayfever, pollen must not only be blown into the nose and eyes but the molecules causing the symptoms must pass through the mucous membranes into the deeper tissues beneath.

EXCAVATING a recently found log stockade built by Indians in Georgia, government archeologists expect to show modern America what an old Creek Indian town looked like. A presidential proclamation authorizing addition of five acres of land to the Ocmulgee National Monument near Macon, Georgia, makes possible the excavations. CCC enrollees supervised by National Park Service archeologists will do the work. Postholes of the stockade are so well preserved that every log can be placed where the Indians had them, if the stockade is reconstructed. House sites of the Indian village are marked by little green plots of ground, different in texture from land that had no construction on it. Mounds that were landmarks of the ancient settlement are in evidence, and the gaming grounds, where the Creeks played their favorite games, can be made out.

ONE of the new sulfa drugs, sulfadiazine, is as effective in pneumonia and other similar infections as the best of the older chemical treatments, but with less discomfort due to the treatment, is reported by Dr. Maxwell Finland, Elias Strauss and Osler L. Peterson in the *Journal* of the American Medical Association. Toxic effects were relatively mild and infrequent, only 9.2 per cent. becoming nauseated. Sulfadiazine was used in the treatment of four hundred and forty-six patients with various infections. It appeared to be highly effective in the treatment of the following diseases: pneumococcic, staphylococcic and streptococcic pneumonias; meningococcic infections; acute infection of the upper respiratory tract including sinusitis; erysipelas; acute infections of the urinary tract, particularly those associated with *Escherichia coli* bacilluria and acute gonorrheal arthritis.

RECOVERY from one attack of infantile paralysis is no insurance against further attacks from the disease, according to Dr. Howard A. Howe, of the Johns Hopkins University, and Dr. David Bodian, of the University of Chicago, who spoke before the American Neurological Association. They reported experiments with animals that show that immunity resulting from the disease is local, just where the virus has traveled along the fiber pathways of the nervous system. Animals convalescing from an attack which affected the brain were able to contract the disease again through the nose. And two monkeys that had had an attack of infantile paralysis confined to a limited section of the spinal cord contracted another typical case of the disease in the previously uninvaded portion of the central nervous system.

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## SCIENCE NEWS

Science Service, Washington, D. C.

## EVAPORATION

AN invisible river, flowing straight uphill, returns to the air a large proportion of all rain and snow that falls. Its name is Evaporation.

At the Hydrologic Conference recently held at State College, Pa., Dr. C. W. Thornthwaite, of the U. S. Soil Conservation Service, outlined the magnitude of this skyward drainage, and told of progress in its measurement. Of one year's measured precipitation at the experimental farm at Arlington, Va., of the U. S. Department of Agriculture, nearly half was returned to the air by evaporation from the soil surface and transpiration through the leaves of plants.

The practical importance of this way of getting rid of surplus water was suggested by the speaker: "In central and eastern United States nearly all major flood-producing storms are terminated by invasion of relatively dry air masses of polar continental origin characterized by a thick turbulent layer and low concentrations of water vapor. These air masses provide conditions most favorable to evaporation and are able to absorb enormous quantities of moisture from the rain-drenched land. Since floods on large watersheds are most frequently due to general storms which must first restore to the soil reservoir water which had previously been lost by evaporation and transpiration it is evident that land use practices favoring evaporation will accordingly lessen the burden imposed on stream channels by excessive rains, both by retarding immediate run-off and by creating a water-storage capacity in the soil."

Dr. Thornthwaite stated that transpiration through plants carries off much more water than direct evaporation from the soil. For this reason, it is desirable to encourage maximum coverage with plants of high transpiration rate, in regions subject to floods. On the other hand, in regions where drought is the main danger, it is best to promote vegetation with low transpiration rates, so as to leave as much moisture in the soil as possible.

Until recently, direct measurement of evaporation from land surfaces was so difficult that it was considered almost impossible. Now, intricate mathematical formulae have been worked out that can give an expression to this mode of water disappearance.

## RADIOACTIVE RUBIDIUM

RUBIDIUM, a chemical element closely related to the more common sodium and potassium, can be made to give off rays like those of radium. In this form it is a useful tool for studying the life processes of living plants. Dr. August Helmholz, instructor in physics; Dr. Charles Pecher, research fellow in the Radiation Laboratory, and Dr. P. R. Stout, junior chemist in the division of plant nutrition, have made these studies, which are reported in the *Physical Review*.

Potassium is an important element in plant nutrition. With the rays from the cyclotron, or "atom-smasher," it can be produced in a radioactive form. Then, fed to plants, its progress may be followed by the rays that it

gives off as it reaches different parts. However, radioactive potassium quickly decomposes. Half of any amount is gone within twelve hours, and this has imposed a limit to its use.

Rubidium, however, is so similar chemically to potassium that it may be used in its place. Its radioactive form lasts for nineteen days. Another advantage is that very minute quantities may be made with high activity, but it can also be produced in relatively large amounts.

In preparing radioactive rubidium, these modern alchemists start with an entirely different element, strontium. Under the influence of 16 million volt atomic bullets from the cyclotron the transmutation into rubidium takes place.

## SEED OF TREES FOR ICELAND

WESTERN HEMISPHERE help is going to Iceland in a hitherto unreported form. Thousands of seeds from two species of evergreen trees, gathered high on Colorado mountains, have been sent to Hakon Bjarnason, chief of the Iceland Forestry Service, by Jacob Jauch, of the U. S. Forest Service. The story of the sending of the seeds is told in the July issue of the *Journal of Forestry*.

The two tree species represented are corkbark fir and Engelmann spruce. Both are high-altitude trees, well suited for the severe weather conditions that prevail on the upper levels of the Rockies. Mr. Jauch states that he awaits with interest the results of this experiment to see if these trees will thrive in sub-arctic Iceland. Although the island republic lies just south of the Arctic Circle, he points out, the climate along its southern coast is so modified by warm ocean currents that it is actually no more severe than that of New York, and materially milder than the climate of the high Rockies.

Iceland once supported a much better timber growth than it now does. While the island was directly controlled by Denmark, it was pretty badly exploited and lost most of its trees and a considerable part of its best pasture land. Since Iceland declared its independence, acknowledging only the personal sovereignty of the Danish crown, its affairs have been better managed and efforts are being made to conserve and restore its natural resources.

So hard pressed are the Icelandic herdsmen, however, that constant vigilance has to be exercised to keep them from turning their sheep loose in growths of young birch trees, which the Iceland Forestry Service wants to grow up into usable timber. A good deal of Mr. Bjarnason's work has to do with maintaining fences around his woodlands.

## TUNG TREES

SUPERIOR varieties of tung trees, source of the tung oil highly valued in the paint and varnish, linoleum, printer's ink and other industries, are being given an extensive test by the U. S. Department of Agriculture. Because the Chinese war has drastically reduced imports from the principal source of this oil, while domestic plantings now in existence supply only a very small percentage of American requirements, new sources within the bound-

daries of the United States are very seriously needed.

Tung cultivation should not be undertaken by amateurs, and it should not be attempted on a large scale even by experienced planters of other crops. Tung trees are very "fussy" about their soil, highly sensitive to cold, and in any case must reach the age of five years before they come into bearing. Still, any farmer far enough south (within about a hundred miles of the Gulf Coast) might find it profitable to set out a few trees, just as an experiment. Tung trees are quite ornamental, with glossy, heart-shaped leaves and beautiful flowers in spring.

Investigators of the Department of Agriculture, during the past three years, have selected five hundred trees in the extensive orchards already growing in the South as particularly promising. A second selection reduced the number to eighty. Thousands of young trees were propagated from this group. The freezing weather of last November cut down the nursery stock severely, but the survivors—some 40,000 of them—have been planted in thirteen test orchards along the Gulf Coast, from Texas to Florida.

In the meantime, chemists in the department have greatly improved the efficiency of oil extraction methods. American tung oil already commands a premium over the imported product, and the market is far from being saturated.

### HORMONE PRODUCTION BY THE THYROID GLAND

HOLDING a clock on the thyroid gland to time its production rate as a chemical factory, investigators of the University of California at Berkeley find that it takes two hours to manufacture its highly complex hormone. This is the first time the formation of a hormone of any of the body's endocrine glands has been measured. The measurements were made by Dr. I. L. Chaikoff, Dr. I. Perlman and M. E. Morton, using tagged atoms of radioactive iodine from the atom-smashing cyclotron. The course of radioactive iodine fed to laboratory animals was traced from the stomach to the thyroid by an instrument sensitive to the radio waves given off by the charged atoms. It took but a few minutes for the tagged iodine to reach the thyroid gland, and within two hours after the iodine had been given it was synthesized into the thyroid hormone and on its way to various parts of the body.

There are two products of the thyroid; diiodotyrosine, the rôle of which is uncertain, and thyroxin, believed to be the true hormone. Under-production of thyroxin in youth will stunt physical and mental development. Over-production of thyroxin in children results in giantism. This hormone is important in the adult, also. An over-active thyroid increases the rate of metabolism so that the body burns up energy substances faster than they can be replaced by food, making the subject thin and nervous, as in some goiter patients. A lazy thyroid results in physical and mental debility, and often abets extreme over-weight. So a better understanding of the course of the thyroid hormone in the body, made possible by the tool of radioactive iodine, may lead to important results.

### DEAF CHILDREN

PUTTING little deaf children and those with good hearing together in a nursery school is helpful to both, if the school is well conducted, according to Carmelita Klorer of the Central Institute for the Deaf at St. Louis.

Miss Klorer has conducted experiments to observe the play of deaf and hearing children, together and separately. Deaf children, aged three years and two months to five years and five months, talked more than hearing children in almost every play situation. But when playing with other deaf children, or alone, the deaf child is apt to use far more gestures than when he plays with hearing children. Miss Klorer concludes that "This is perhaps the best argument favoring the combined nursery school, as the deaf realize that gestures are not always the best means of social intercourse."

Clay was a favorite play material of the deaf children, with blocks as second choice. Hearing children selected blocks and books with equal frequency, and clay almost as often. The deaf showed greater skill in handling constructive materials. When deaf and hearing children played together deaf children took the initiative, drawing the hearing children into their play.

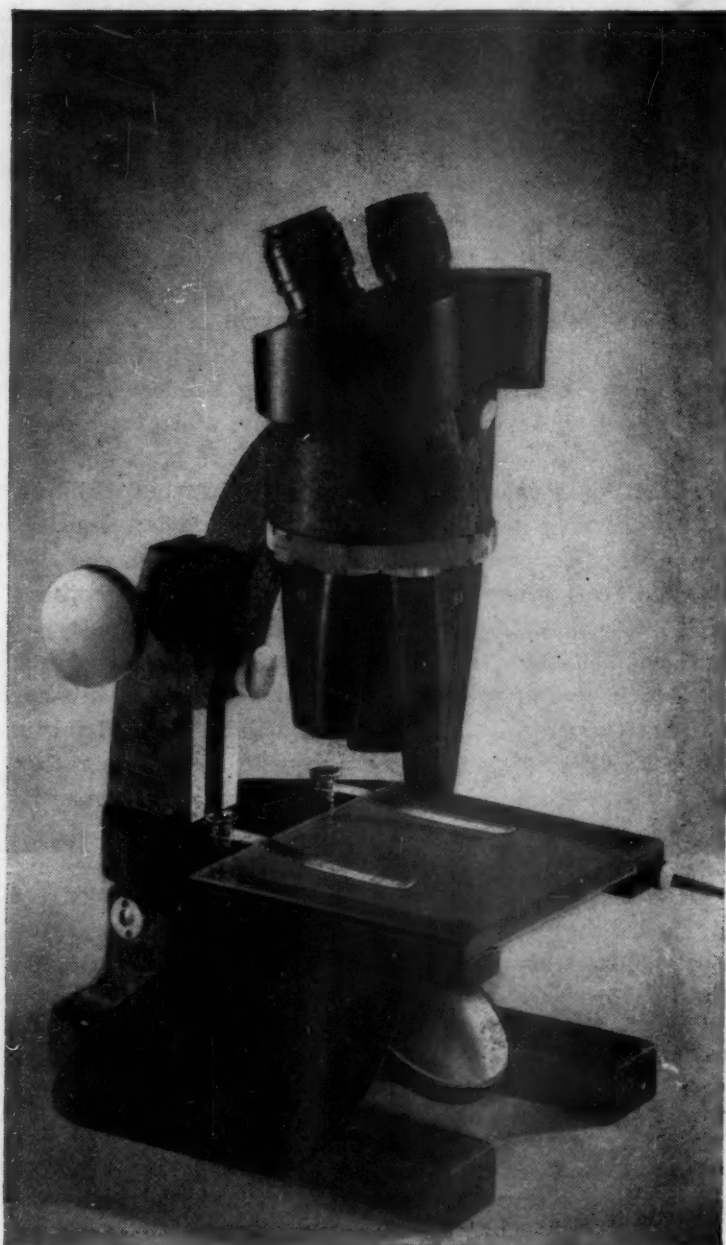
Advocating grouping deaf children with those who hear in nursery schools, Miss Klorer states that both types need to be taught cooperative play, and social contact with their own ages, and opportunities to develop in emotions and in stability. For the deaf children, added values result from contacts that cause them to use speech rather than gestures, and give them a normal play environment.

### ITEMS

How to avoid injury to citrus fruits while ridding trees of scale insects with cyanogen gas fumigation was the object of experiments reported by E. T. Bartholomew, W. B. Sinclair and D. L. Lindgren, of the Citrus Experiment Station of the University of California, at Riverside. In fumigating orchards, a tent is placed over each tree to be treated and the cloud of deadly gas released within the confined space. Too great a concentration of the deadly gas, or too long continuation, will cause injury to fruit, rendering it unmarketable. The experiments showed that one effective way to decrease cyanogen injury to fruits was to maintain a relatively high temperature overnight, before fumigating. A temperature of 80 degrees Fahrenheit was most effective in preventing injury, with effects at 65, 50 and 43 degrees lessening in the order named.

It has been demonstrated that a death ray may prove a blessing to sanitation. Infra-red rays produced by a special incandescent lamp were turned on adult cockroaches. Those within eighteen inches of the invisible rays were pronounced dead four minutes later. Dr. Guy F. MacLeod, lecturer in entomology in the College of Agriculture of the University of California, reported these results of laboratory experiments on cockroaches, but could offer no practical method of using the rays to destroy pests in household or restaurant kitchens. Infra-red rays were also tried on various plant pests. Unfortunately, the plants were injured or killed before the infesting insects were killed.

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## SCIENCE NEWS

*Science Service, Washington, D. C.*

## SOME PAPERS READ BEFORE THE DURHAM MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

CONTROL of soil erosion is being placed on a thoroughly scientific basis for the first time in the world's history, was pointed out by Dr. Hugh Bennett, chief of the U. S. Soil Conservation Service, in an address given at the meeting of the American Association for the Advancement of Science. The ancient world developed some remarkable engineering works designed to stabilize hill-side soil, but not until the American soil conservation program got under way was there a convergence of such a diverse array of knowledges and skills as now puts up a defensive battle against erosion. Any given project will call for the services of crop experts, engineers, foresters and possibly other types of scientific workers. Before actual work is started on a farm or group of farms, a thorough survey is made. Each field is classified according to soil type, slope, extent of erosion and land use. Maps based on such surveys guide farmers in the more advantageous and economic use of their land. Already 90 million acres have been thus surveyed. Particular attention has been given to the problem of producing crops without constantly turning the soil over and thus exposing it to accelerated erosion. The Soil Conservation Service has developed a technique known as "stubble mulching." Crop residues are left on the surface while the soil underneath is plowed with a subsoil tiller. The residues thus provide surface protection which checks runoff by keeping the surface soil in such condition that nearly all the water soaks into the ground. This reduces evaporation from the surface and helps protect the land against both wind and water erosion.

DR. W. C. LOWDERMILK, of the U. S. Soil Conservation Service, in an address before the opening session of the American Association for the Advancement of Science, pointed out that North Africa and the Near East, scourged for the thousandth time by war, have suffered even more during intervals of peace than from the havoc of actual armed strife. Partly because of war-caused paralysis of civil life, partly from internal disorder and weakness, soil-conserving practices begun by good farmers ages ago have been permitted to fall into disuse, and the impoverished soil has eroded to bedrock. Dr. Lowdermilk drew a lesson for America from the history of these classic lands. Here, too, there has been neglect and wastefulness in land use, and soil erosion has started at an alarming rate. However, the speaker concluded, "this destructive force did not go unheeded. Far-sighted students of land foresaw the dangers of soil erosion. But it was not until experimental studies were begun by which it was possible to measure comparative losses of water and of soil under various types of cropping, slopes and climates, that the magnitude of the menace could be measured. On the basis of these researches, a nation-wide program of demonstration projects in erosion control and soil con-

servation showed the farmer and the technician alike how this enemy of civilization might be controlled. Out of these steps has grown a movement for conservation of land resources which was founded upon the lessons of the past and science of the present. Continued progress in this movement of conservation must be founded on the adaptation of the findings of research to problems in land use that become more and more intricate as the demands upon the land increase."

DR. H. L. SHANTZ, of the U. S. Forest Service, pointed out that the nation's resources were divided into two categories, renewable and non-renewable. The latter are of mainly mineral origin. Some, notably the metals, last a long time and can be reworked several times before they vanish out of circulation. Others, especially coal, oil, natural gas and fertilizer deposits like phosphates and potash, are completely expended the first time they are used. Non-renewable also are species of plants and animals: once exterminated, they can never return. Renewable resources include water power, plant products and animal uses of plant products. These came back in cycles; every year in annual crops, over longer periods in forest products, perennial in water power. These are the things that should be used most freely, and should be substituted for non-renewable resources where that can be done, as in the use of plastics instead of metals. The soil occupies an intermediate position. If it is permitted to waste itself through erosion, it is strictly a non-renewable resource. If it is properly conserved, it moves into the renewable category.

SNOW was the subject of a paper by Dr. Henry I. Baldwin, of the New Hampshire Forestry and Recreation Department. Dr. Baldwin told of measurements taken of snow depth under various types of forest cover. Early in the winter, he said, trees serve as snow umbrellas, preventing much of the white precipitation from reaching the ground. Later, when snow depth in the woods is as great as or greater than it is in the open, the trees conserve moisture, preventing the snow from returning into the air as water vapor. Young stands of trees, in Dr. Baldwin's observations, intercepted relatively more and conserved less than older stands. Hardwoods exerted less influence than conifers; young hardwood sprouts least of all. Snow in the forest lasted from one to three weeks longer than it did in the open.

NEW ENGLAND shares with the Pacific Northwest the obscure honors of having most cloudy weather in this country, was reported by W. B. Liverance and Professor C. F. Brooks, of Harvard University. This northeastern cloudy area extends as far west as the Great Lakes, and is characterized by its processions of storms marching down the St. Lawrence Valley. Of possible sunny days, New England gets only 50 per cent. This contrasts with the extreme Southwest, which gets 85 per cent. of all possible sunshine.

NEW evidence that Mount Washington was completely immersed in the vast sea of ice that once covered most of the northern United States was advanced by Professor Richard P. Goldthwait, of Harvard University. A pocket of soft, sticky till, which could have been produced only by a glacier and which contains a few pebbles carried up the mountain from lower valleys by the ice, was recently uncovered during excavations for new buildings on the mountain-top. Such glacier-borne stones, also found elsewhere atop the Presidential Range, came from ledges between 2,000 and 4,000 feet farther down. There is evidence that the last of the glacial ice disappeared from the top of Mount Washington not more than 25,000 years ago.

CONDITIONS leading to icing, the worst nightmare of aviators, are being thoroughly but safely studied by putting a laboratory on solid earth at airplane altitude. The program of icing research being conducted at the summit of Mount Washington were described by David L. Arenberg, of the Blue Hill Observatory of Harvard University. Under investigation are such points as measuring the liquid water content of icing clouds, development of the critical changes in the transition from frosty rime to solid ice, relation to icing of such factors as drop size, wind, temperature, etc. The observatory is also serving fliers in the region by transmitting warnings of ice-forming conditions aloft.

GEORGE W. TRAYER, of the U. S. Forest Service, stated that wood wins wars, despite the apparent primacy of metals. It has the further advantage over metals, that it can be grown as a renewable crop if good forestry practice is observed, whereas metals are definitely limited and exhaustible resources. Even in airplanes, where aluminum and magnesium have replaced the spruce and fabric of the earlier flying fighters, wood is staging a comeback. Plastic-bonded plywood is coming to the rescue of an industry harassed by a shortage of light metals. Smaller planes of this revolutionary new construction, with laminated wooden propellers, have proved entirely practicable for training purposes—and training planes are needed by tens of thousands. A modern army's needs for wood are almost beyond counting. They range all the way from lumber for barracks and heavy timber for bridges to wooden poles for holding up camouflage nets and wooden crates for the safe transport of ammunition. Chemical uses for wood are important in warfare. Wood pulp can supply cellulose for nitrating into explosives quite as good as that derived from cotton linters. Black powder, still used to a limited extent in modern war, contains charcoal as an essential ingredient. Compressed wood charcoal now replaces the coconut-shell charcoal of World War I in the canisters of gas masks.

HEAVY war-time demands for wood threaten to work hardship on New England forests because they are so close to the points of most acute demand and transportation is at a premium, was pointed out by C. Edward Behre, also of the U. S. Forest Service. In pre-emergency days, New England's forests were supplying less than half of the region's needs for lumber, pulp and other

wood products, and the present great increase in demand, coupled with overloaded railroads and a shortage of ships, are creating a difficult problem. The problem is further aggravated by a threatened fuel shortage, which will result in a considerable use of wood as replacement for coal and fuel oil next winter. Mr. Behre concluded by calling for public control as the only way to avoid confusion in meeting the prospective demand for major forest products and to prevent needless sacrifice of the productive resources. Nothing is more important, he added, than that our productive resources be in position to support labor and industry in the post-war readjustment.

THE latest results in a 90-year-old mathematical problem, that of map coloring, were reported to the section of mathematics by Professor Daniel C. Lewis, Jr., of the University of New Hampshire. The problem is to prove that various districts in a map, the forty-eight states of the United States, for instance, may be tinted with only four colors and still not have the same colors touching, on opposite sides of a common boundary line. It is known that three are not enough, while half a century ago it was proved that any map, no matter how large or complicated, could be colored with five colors. So far no one has ever constructed a map that can not be colored with four tints, but mathematicians are still seeking a rigorous proof of this. Two lines of attack have been made on the problem. One is the notion of an irreducible map, that is, one that can not be colored with four colors, but such that any map with fewer districts can be. Last year it was shown that an irreducible map can not have less than 36 districts. It is hoped eventually to prove that an irreducible map can not exist at all. The other method is known as that of chromatic polynomials, and Dr. Lewis has been working in this field in collaboration with Dr. George D. Birkhoff, of Harvard University. He told of their latest researches, which show that the characteristic methods used in working with irreducible maps can be adapted to more general considerations involving the polynomials. Hence, these latest developments include the previous work, and probably bring nearer the complete solution of the four-color problem.

CHEMICAL lures may eventually be used as protection for crops, instead of the barrages of poison spray with which plants have to be drenched now-a-days. It may become possible to mislead insect pests to lay their eggs in chemically scented traps, instead of on plants, was suggested by Dr. V. G. Dethier, of John Carroll University. Dr. Dethier has been experimenting with many kinds of insects and many kinds of chemical compounds found in plants, to get some idea of what induces certain species to lay their eggs on just one or a very few kinds of plants. The cabbage butterfly, which never lays its eggs on anything but the leaves of cabbages and related plants, was attracted by compounds found in just that group of plants. The orange puppy, a troublesome pest of citrus trees, is lured by the scent of two chemicals, citral and methyl-nonyl-ketone. The tent caterpillar has a decided preference for poison in small quantities: it hastened to a bait of hydrocyanic acid and benzaldehyde. Dr. Dethier demonstrated that insects are guided by their

chemical sense by impregnating filter paper with the chemical compounds preferred by various species. Each insect went to the paper scented with its favorite luring odor and proceeded to make a meal of it, despite its lack of other resemblances to leaves and its obvious indigestibility.

CONQUEST of human hunger in the United States was demanded by Gove Hambidge, editor of the U. S. Department of Agriculture Yearbooks. It is not so much the absolute want of sufficient food, or even the acute lack of certain vitamins that results in such gross symptoms as rickets and pellagra that most demands national attention, he said; fortunately for us, actual starvation and acute vitamin unbalance are relatively uncommon in this country. The real need is for correction of marginal or partial lacks that reduce efficiency and the sense of well-being below their potential optimum point. This calls for a four-point program: (1) research into the nature and magnitude of nutritional needs, (2) translation of technical knowledge thus gained into terms "understood of the common kitchen," (3) discovery of the magnitude and distribution of malnutrition, (4) research into its causes. Mr. Hambidge said: "I can think of no more fascinating challenge to cooperation than the conquest of hunger in the United States. For it will mean that the nutritionist, the medical man, the educator, the psychologist, the sociologist and economist, the agricultural scientist, the farmer, the worker in the food industries, the community leader and the ordinary citizen will have to pull together in many ways, some of which have not been tried before. The whole picture of the rôle of food in the human body given us by modern science shows that this effort is not only worth while but vital at this time. The right food is by no means the only factor, but it is certainly the most fundamental one in health, strength and morale. If there ever was a time when every citizen, bar none, needs to be at top pitch in health, strength and morale, this is it."

DR. WILLIAM RAAB, of the Medical College of the University of Vermont, stated that heart diseases, of several different types, are due to abnormal functioning of the suprarenal glands, small bodies above the kidneys that furnish adrenalin and other hormones necessary for the normal functioning of the body but harmful in excess. In experiments on rats it was found that the heart muscle seems to have a peculiar affinity for adrenalin and its associated hormones. The animals' hearts absorbed more of these adrenocortical compounds than did other organs. An overdose, above a certain definite concentration, inevitably resulted in death by heart failure. Experimental data are backed up by clinical results, the speaker claimed. In the too-common and exceedingly painful heart disease, angina pectoris, it was found that physical exercise resulted in excessive discharges of the hormones into the blood stream, and these in turn provoked typical attacks. In a number of cases, where the glands were partially inactivated by x-ray treatment, these abnormal discharges were abolished for many months, with parallel disappearance of the anginal attacks. He traced similar apparent connections between abnormal discharges from the suprarenal glands and other types of heart disease, including

essential hypertension and congestive heart failure. Assay of the heart muscle, in autopsies of patients who had died of heart failure, showed abnormal amounts of the hormones. Usually these were excessive, but in some cases subnormal concentrations were found. Summarizing his results, Dr. Raab stated: "It can be said that normal functioning of the heart muscle is dependent on the presence of normal amounts of adreno-cortical (AC) hormones in its tissue. Both abnormal increase and diminution of the myocardial AC are likely to bring about heart failure. Intense AC discharges into the blood stream going on over years and decades stimulate, exhaust and finally damage the myocardial tissue in a similar manner as they stimulate and ultimately damage the muscular walls of the arteries."

#### ITEMS

WITHIN five minutes of the time that a hydrogen eruption on the sun was recorded at the Mount Wilson Observatory in California, a definite fade-out of radio signals received at Washington from Toronto was recorded at the National Bureau of Standards. Though such records are ordinarily studied only monthly, T. R. Gilliland, of the Radio Section, examined them for July 3, the date of the eruption, at the request of Science Service. He found that, within five minutes after the eruption began on the Mount Wilson film, the intensity of the Toronto signal dropped nearly to zero for about five minutes. Then it recovered, but later in the morning it dropped again, and remained down for about two hours.

COOKING by the sun's rays may be made easy with a new invention just granted U. S. Patent 2,247,830. It was issued to Dr. Charles G. Abbot, secretary of the Smithsonian Institution, who has for a number of years been experimenting with methods of using directly the energy from the sun. One object of the invention is "to provide a novel solar heater which is highly efficient, compact, cheap to manufacture, durable and easily used by the inexperienced." Another is that it "may be made of any desired small size without decreasing the efficiency." To collect the sun's rays there is a metal mirror, bent to the shape of a parabola. Its long direction is parallel to the axis of the earth, and there is a clockwork to turn it during the day to follow the sun. In this mirror, where the solar rays are sharply focused on it, is a double-walled glass tube, through which circulates a black liquid with a high boiling point. This absorbs the rays and is heated. The hot liquid then circulates through an oven at the upper end of the device, so that it may be used for cooking.

STATING that the "existing Atlantic commercial air services have proved totally inadequate," daily, and even twice-daily, flights are urged in an editorial in a recent issue of the British aviation weekly, *Flight*. It points out that "The number of people to whom time is all-important is considerable now, and will grow rapidly as our association with the United States increases in volume and closeness," and that "at the very least there should be a daily service, and the time will probably come when a service every twelve hours will be assured of a full load on every trip."

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## SCIENCE NEWS

*Science Service, Washington, D. C.*

## CAUSE OF THE NIGHT GLOW OF THE SKY

THE soft glow of the sky at night is not just starlight and moonlight, but is due to the magnetic activity of the earth and its atmosphere. Definite evidence to support this fact has been reported at the Lick Observatory. Donald R. Barber, a British astronomer who has been working at the observatory for the past year on a fellowship, conducted the research. Astronomers have long speculated on the cause of the night glow, which is visible even on moonless nights. Those who attempted telescopic photographs have often had their photographic plates clouded by this eerie light which varies from night to night and from hour to hour.

Astronomer Barber systematically measured the night glow in a small area near the north star, a part of the heavens that is always conveniently situated for observation. Systematic measurements of the earth's magnetic field were made simultaneously, and comparison of these measurements proved a direct relationship between the two. Magnetic currents which ceaselessly flow around the earth are probably stimulated by radiations from the sun, principally active during daylight hours. The readjustment of the night atmosphere from solar disturbances of the day before probably are the cause of the heretofore unexplained night glow.

Mr. Barber's finding not only gives an answer to another of the mysteries of the heavens, but will be of practical use to future study. By scientific observation of daylight magnetic conditions, the intensity of the coming night glow may be predicted, assuring greater success for long exposure photography by the choice of less bright nights.

## THE STUDY OF COSMIC RAYS

INVESTIGATORS from seven institutions will gather this summer on top of Mt. Evans, near Denver, 14,259 feet above sea-level, to study the mysterious cosmic rays from space. Scene of their convocation will be the Cosmic Ray Laboratory of the University of Denver, the Massachusetts Institute of Technology and the University of Chicago, now in its fourth season.

Already at work, or soon to arrive, are parties from Washington University, St. Louis; Kenyon College, Ohio; the University of Chicago; the Bartol Research Foundation of the Franklin Institute of Philadelphia; Cornell University, Colorado State College and New York University. Each group is bringing a special type of equipment.

That of Kenyon College, a portable laboratory in a bus, using cloud chamber equipment to trace the course of the rays through air filled with water vapor, is already at the top of the peak. It is directed by Dr. Wilson Powell, working under a Guggenheim fellowship.

Dr. E. J. Shremp and M. L. Yeater, of Washington University, St. Louis, also are operating their device. It is a "Ferris wheel" six feet in diameter, with 72 Geiger counters mounted on the rim. It is turned slowly, and

as it turns it records the arrival of cosmic rays from eighteen directions at once. An automatic camera photographs the counting panel at regular intervals. It was built last fall and operated in St. Louis. Now it is at the University of Denver, 5,200 feet above sea-level, and next season will be taken to the top of Mt. Evans, if there is a sufficient electrical supply there—it draws a heavy current.

Dr. Joy C. Stearns, head of the physics department of the University of Denver says it is planned to have a Diesel engine at the Mt. Evans laboratory next season. Cornell has indicated it will share the expenses of the laboratory with the other institutions. Its interest is due to Dr. Bruno Rossi, of Cornell University, who has been conducting experiments on Mt. Evans for two seasons, and is returning this summer. His problem is to determine the "life period" of mesotrons. He is also making observations from Denver and from Echo Lake, 10,800 feet high.

Dr. Arthur H. Compton, of the University of Chicago, one of the founders of the laboratory, will come in August from the Andes, where he and a party are now conducting cosmic-ray research.

These investigators can live near their instruments this summer in the new turtlebacked hostel being completed on the summit of the mountain, about 100 yards from the laboratory. In previous years they had to drive back and forth eleven miles from Echo Lake Lodge, 5,000 feet below. The road is also being oiled to the top of the mountain. It is the highest oiled road in the United States.

## MEASURING THE HEIGHT OF AIRPLANES

Two methods of radio distance measurement, enabling pilots of airplanes to tell not only their distance above the ground, but also, in the case of one of the inventions, that from some reference station as well, are included in patents recently issued by the U. S. Patent Office.

To Dr. Ernst F. W. Alexanderson, engineer of the General Electric Company, who has made many inventions pertaining to radio and television, was granted patent 2,248,599, which he assigned to his employers.

Frequency modulation, which is making possible static-free broadcasting, is used in this system. However, Dr. Alexanderson describes it as "a new and fundamentally different method" for distance measurement. Very simple apparatus, compared with some of the complicated devices that have been used for a similar purpose, is required.

From the airplane is sent out a high frequency radio signal, which is reflected back from the ground so as to create a series of standing waves below the aircraft. The frequency, or rate of vibration, of the transmitted wave is varied with great rapidity—so fast, in fact, that when the reflected wave has turned to the plane, and is picked up by a receiver, the frequency change has made a complete cycle. The transmitter is then sending out signals



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of the same frequency as when the wave left—or at least of some definitely related frequency. The farther away the ground, the longer it takes the reflected wave to return, and the more slowly need the frequency be changed. The receiver picks up both the original wave, which has traveled but a few feet, and the reflected one. If the two frequencies are the same, there is none of the beat frequency between them that would occur if the two were out of step. In use, the control knob of the transmitter is graduated in terms of altitude. It is turned until the beat disappears, and then the height above the ground is indicated.

The other radio distance device won patent 2,248,215 for Horace T. Budenbom, who assigned his rights to the Bell Telephone Laboratories, of New York City. Instead of using a high frequency, or short wave, he uses a low frequency, with a very long wave. The wave, in fact, is somewhat longer than the distance to be measured. By receiving it with two different receivers, each with its own special aerial, it is possible to determine the distance between the transmitter and the receivers, in terms of the length of the wave. The indications are made on a phase indicator, of which various types can be used. This can be calibrated in terms of one or more of the wave-lengths used at the transmitter so as to show directly the actual distance.

In a modification of the device, the airplane sends out a signal from a transmitter, to a receiver on the ground. This automatically retransmits it, and it is received back at the plane. Then the apparatus tells the time that was taken. In one form of Mr. Budenbom's invention, the altitude as well as the distance from the ground station are given with the same receiver. Since the ground-reflected wave that tells height comes back much sooner than the retransmitted one for distance measurement, it is possible to separate them by electrical filters, so that each is indicated on its own dial.—JAMES STOKLEY.

### PEELED WHEAT BREAD

By eating whole wheat bread instead of white bread you get more proteins for energy and tissue building and more minerals as well as more vitamins, was discovered by Dr. John R. Murlin, of the University of Rochester, as a result of diet studies with a squad of ten young men as voluntary subjects. The studies were reported briefly to the recent National Nutrition Conference in Washington.

Dr. Murlin stated that "if the peeled wheat bread were consumed by the average man of this diet squad instead of white bread for one year, on the calorie basis he would save enough total calories to supply him for approximately thirty-six days."

Peeled wheat bread is made from wheat prepared by the Earle flotation process which removes only the thin epidermis of the wheat berry constituting not more than 2 per cent. of the whole grain.

In addition to the 36-day calorie supply saved in a year of eating the peeled wheat bread, the man "would get 24/100 lb more calcium, 1.1 lb more phosphorus, and one-quarter of an ounce more iron, besides all the vitamins native to the wheat and a significantly higher biological value of the protein." The biological value of the protein indicates the amount digested and actually absorbed

by the body, not merely the amount in the food eaten, some of which may be lost from the body.

The young men on the diet squad ate a standard diet in which whole egg furnished most of the protein for six days, then ate the same diet with the protein furnished chiefly by a so-called "100 per cent. whole wheat bread," then the egg diet for six days, then a diet with the peeled wheat bread, back to the egg diet, and finally a diet in which the whole wheat product was shredded wheat biscuit. The whole period covered seventy-six days.

Taking egg protein as 100 per cent. the three whole wheat products had biological values of 77.8 per cent. for the so-called 100 per cent. whole wheat bread; 79.6 per cent. for the peeled wheat bread; 81.6 per cent. for the shredded wheat biscuits; and 75.3 per cent. for white bread. The differences between the white bread and the two highest whole wheat products were statistically significant. Differences with respect to the utilization of starches and fat in the white and whole wheat breads were not significant.

### ITEMS

DR. W. Z. HASSID and R. M. McCready, of the University of California, have sent the following correction: "In the issue of SCIENCE for July 4 under Science News Supplement, p. 12, an item appeared crediting us as being the first ones to produce starch synthetically. We wish to correct this erroneous impression. Due credit for this important achievement should be given to C. S. Hanes, of the University of Cambridge, who first synthesized starch from the Cori ester by the action of potato phosphorylase and reported this work in *Nature*, 145, 348 (1940).

"We prepared synthetic starch by using Hanes's method and made a comparative study of the molecular constitution of this synthetic compound with that of natural starch. A full report of these results will appear in the August issue of the *Journal of the American Chemical Society*."

ACCORDING to officials of the U. S. Public Health Service there were 187 cases of infantile paralysis throughout the nation during the week ending July 12. This is an increase of more than a hundred cases over the previous week and is about fifty cases above the expected figure shown by the five-year median. Whether an epidemic is beginning can not yet be determined. One authority has pointed out that in years of serious epidemics, the number of cases usually started to rise abruptly in June. The largest number of cases, and the biggest increases, occurred in the South. Georgia reported forty cases, Alabama had forty, Kentucky ten.

WATCH out for sun-caused trouble with radio and telegraphic communications toward the end of July. This is the possibility pointed out by astronomers at the Carnegie Institution's Mt. Wilson Observatory at Pasadena based on the fact that the sun revolves every twenty-seven days. A flare-up in the atmosphere of the sun caused severe magnetic disturbances and interruption to radio circuits on July 4. When the same region of the sun is turned toward the earth about July 29 or a few days later, these disturbances may be repeated. There may then be auroras as well as disturbed radio and telegraphic communication.

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## SCIENCE NEWS

*Science Service, Washington, D. C.*

## DAYLIGHT SAVING

If the exigencies of power shortages for defense work force the United States again to adopt daylight saving time on a national scale, it will represent another in a long series of steps aimed to make our clocks suit the convenience of man.

If the earth were flat, as the ancients thought it to be, time would be much simpler. But it is a ball, turning on its axis, which gives us a natural unit from which others are derived. It is this turning, from west to east, that carries us with it, and makes the sun, moon, stars and other heavenly bodies seem to rise in the east, go across the sky and set in the west. The time of this turning is the principal natural time unit—the day—but even this is complicated because there are two principal kinds of day, differing in length by nearly four minutes.

If you watch a certain star rise, and wait until that same star rises again, you have counted one turn of the earth. This is the "sidereal," or star, day, and is used by astronomers. They do not watch the rising of a star, but the time that it crosses the meridian, when it passes from the eastern to the western half of the sky. But now, suppose you watch the sun cross the meridian, and wait until its next crossing. Then also you have a "day," but this kind, the "solar" day, is, on the average, 3 minutes 56 seconds longer than the sidereal day.

The moment the sun crosses the meridian is noon, but obviously the meridian of Washington is not that of Chicago. No two places on earth have the same meridian unless one is exactly north or south of the other. A century ago each community used its own solar time, based on its own meridian, but even this was not sundial time.

Though the sun lags behind the stars on the average of 3 minutes 56 seconds daily, this is not constant. It ranges nearly half a minute either side of this mean. At some times of year sundials run faster, at other times they are slower. So astronomers imagine there is a sun—they call it the "mean" sun—which does advance uniformly through the starry sky, and "mean solar time," based on this imaginary orb, is the kind that used to be employed.

With the coming of the railroads and the telegraph, it was most inconvenient to have the time changing every time one moved east or west. So in 1883 Standard Time was adopted, first in the United States, then throughout most of the civilized world.

This system divides the United States into four zones, roughly centered at 75 degrees, 105 degrees, 120 degrees and 135 degrees west longitude. Any zone uses throughout the mean solar time of its central meridian, each of which differs exactly one hour from the next. With this system, you only change your watch when you pass from one zone to the next. The alteration is just an hour, and not some odd numbers of minutes and seconds.—JAMES STOKLEY.

## A NEW TYPE OF WEATHER MAP

A NEW type of daily weather map, simpler and more graphic than the old familiar one, is being put into service by the U. S. Weather Bureau. It is being issued only for Washington, D. C., at present, but will be extended to other cities as printing facilities become available. It will eventually become the standard weather map for the entire country, but the change-over will take several years, according to Commander F. W. Reichelderfer, chief of the Weather Bureau. This is largely because of time and expense involved in installing new printing facilities to handle the modernized map.

The most striking change in the new map is the substitution of symbols indicating position and movements of air masses for the old familiar concentric ellipses of isobars and isotherms of weather maps in use until now. Isobars are still present, but more widely distributed, so that the map is much less striped-up with these curving lines.

Clustered around each principal observatory, as marked on the map, are a number of symbols that at first glance look somewhat like shorthand, somewhat like old-time Indian sign writing. These tell at a glance the state of the weather, as observed at ground level. The Weather Bureau supplies a code which in 148 symbols and combinations states all possible types of weather, from a summer hot calm to a raging winter blizzard.

Some of the symbols are practically self-explanatory. Thus, a white circle means a clear sky, a black circle signifies a completely clouded sky, while intermediate amounts of blacking-in tell of skies clouded from one tenth or less to nine tenths or more. A zigzag line with an arrow at the lower end means a thunderstorm. An asterisk or printer's star means snow.

A round, black dot, like a big period, is the symbol for a raindrop. One of them means slight rain. Two, one above the other like a colon, means slight, intermittent rain. Two dots side by side mean continuous light rain; three dots, arranged like a pawnbroker's sign, moderate rain; four dots in a diamond-shaped pattern, continuous heavy rain. A comma-shaped symbol indicates drizzle; combinations as indicated for raindrops tell of heavy or light, continuous or intermittent drizzle. The same combinations are used with the star-shaped snowflake sign. Other combinations are more complex, but all appear to be easy to learn.

Two of the symbols are bound to become popular in Nazi-occupied countries. An inverted V-shaped sign means squally weather. Two inverted V's, one within the other, indicate heavy squalls.—FRANK THONE.

## DROWNED MINES IN COLORADO

A GEOPHYSICAL crew headed by Dr. Stephen Capps, of the U. S. Geological Survey, is working in the valley of the Arkansas River, surrounding the old mining camp at Leadville, Colo., in order to determine the best route for

a possible deep-drainage tunnel to unwater Leadville's drowned mines and release the store of rich complex ores that may lie under the water.

Also, they will endeavor to determine the routes of primordial streams, long since buried under hundreds of feet of overburden. It is hoped that the gravels of these streams will prove rich in gold, opening up the prospect of underground placering.

The proposed deep-drainage tunnel, toward which government agencies have been cold because of the lack of proved deep-down metal resources, would be 39,000 feet long, the longest in the history of the metal-mining industry, and 7,000 feet longer than the Carlton tunnel at Cripple Creek, now being completed. It would also be shallower—about 1,100 feet underground, as compared with 3,300 for the Carlton.

Leadville experts insist that the ores are there, and that a combination of uncertain and faulted underground conditions, water, and the many small diverse interests which mined the field and could not get together on a thorough plan of underground exploration, are responsible for the lack of thorough knowledge of the field's deeper resources, rather than the lack of ore. At one time the 10,200-foot-high field, below Mt. Elbert, Colorado's tallest peak (14,431 feet), produced torrents of metal, founded many great fortunes, including that of the Guggenheims. It has produced about \$450,000,000 worth of metals—about \$60,000,000 in gold, nearly \$200,000,000 in silver, more than \$90,000,000 each of lead and zinc, and \$14,000,000 in copper.

It was first discovered as a gold camp, but it languished until a prospector sent some of the heavy black gravel that clogged up the sluices to an assayer. He found it was lead-silver carbonate worth more than \$400 a ton. Then the town really boomed. Some of its gulches, including the famous California gulch, have been washed three times for gold, by more and more efficient machinery. But production last year was only \$489,000.

It is the copper, lead and zinc upon which hopes are based, as much as on the more precious metals. Also there are some 4,000,000 tons of manganese in sight, but of too low a grade to rouse governmental or commercial interest until this metal becomes scarcer. A few miles away is Bartlett Mountain, largest store of molybdenum in the world, owned by the Climax Molybdenum Company.

A big mining company, the Resurrection, has bought the present deep-drainage tunnel, the Yak, about 23,000 feet long, and much of the underground territory surrounding it. This tunnel drains only the higher reaches of the east part of the field, under the Mosquito range.

#### OCEAN STUDIES AT THE UNIVERSITY OF CALIFORNIA

THERE has been much unverified conjecture on the effect of waves and ocean floor topography on shorelines and harbors. Some of these theories are being scientifically settled by Prof. Morrough P. O'Brien, chairman of the department of mechanical engineering, and his associates at the University of California at Berkeley.

Two water tanks have been constructed, one a long, narrow channel 60 feet in length and only one foot wide;

the other 58 feet long and 38 feet wide. The floor of the larger tank is formed into mountains and valleys, resembling the bottom of the ocean. A mechanical wave machine moves plank-like steel plates back and forth through the water producing six-inch-high breakers that crash on an imitation beach of real sand.

One of the first results of experiments with the small ocean was a definite decision between two theories of wave motion. One group of investigators maintained that while waves advanced toward shore the water moves in elliptical orbits. This is called the trochoidal theory. Others have subscribed to the irrotational theory which proposed that the wave motion produced a slow motion of the water in the direction of wave travel. The pigmy waves in the laboratory "sea" proved the irrotational theory correct.

Frank Milner, a graduate engineering student, made another discovery by studies of the model ocean. Many harbors have submarine valleys just off-shore, and Mr. Milner found that these valleys influence the action of waves against the shore. A small valley, duplicating one at Moss Landing in Monterey Bay, Calif., was built into the floor of the tank. Breakers set in motion by the mechanical wave machine were weakened in force and height by sides of the valley which sloped up to the shoreline, so that waves finally broke on shore with much less force. A rip tide formed in the center of this valley. By placing a dye solution in this current, they could follow the direction of the rip tide and found that it ran oceanward instead of toward shore.

The object of these laboratory ocean studies is to set up duplicate coastline conditions and to analyze the movement and force of waves and currents, and the modifying effect of undersea floor formations. A better understanding of these conditions will make it possible to plan better protective means for beaches and to build more effective breakwaters for harbors. These studies should be of practical aid in the designing of large ships, also; particularly large navy vessels.

#### HAYFEVER

HAYFEVER is expected to be bad this year, as ragweeds all over the eastern half of the country prepare to shed their pollen. This growing season has been exceptionally favorable for the development of ragweed, and there is every reason to believe that these ill weeds have exercised their proverbial propensity for growing apace.

To begin with, last year was a "good" ragweed year, too, so that a huge crop of seeds was produced. Although the past spring was rather dry over wide areas, abundant rains have blotted out all memory of the spring drought, and the combination of moisture and warm weather has boomed weed growth.

While no official census is taken of weeds, the U. S. Weather Bureau does maintain a weekly check-up on the state of crops in relation to the weather. Corn and cotton are reported as growing fast (cotton too fast, in fact), and since ragweeds thrive on the same kind of weather that favors these crops they may be taken as indicator plants for the general state of the producers of the pollen.

Another factor that favors ragweeds, at least around

urban areas, is the reduction in the ranks of CCC and WPA workers. One of the regular jobs assigned to groups of these men has been the scything down of ragweed patches. How much actual good such mowings have done is debatable, except in such communities as insisted on having all ragweed cleaned out, on the city dumps and on the wrong side of the railroad tracks as well as in comfortable residence districts. Air-borne pollen flies for miles, so that anti-ragweed campaigns do little good unless they are carried to the point of total extermination.

In some places (perhaps where the Mayor is himself a hayfever sufferer) the ragweed extermination campaign has taken the mistakenly vindictive form of pulling the weeds up by the roots instead of merely mowing them down. This does more harm than good; for ragweeds are annual plants, hence are as effectively killed by mowing as by uprooting. Uprooting even favors the next year's growth, for it loosens the soil and gives better chances of growth to last season's seeds lying dormant for a year or two.

Although ragweeds cause probably nine tenths of all hayfever sneezes, they are not the only shedders of troublesome pollen. Cocklebur, wild hemp, narrow-leaved plantain, several grass species both wild and cultivated, and a number of kinds of trees, all contribute their quota of sneezes and itching eyes at appropriate seasons.

One plant is widely but falsely accused: goldenrod. Its pollen is sticky and heavy, and can travel for only the shortest distances on the wind. It is the misfortune of this fine wayside plant that it breaks into bright bloom just when the green, unnoticed spikes of ragweed are shedding their pollen. So, like many another innocent bystander, it gets the blame while the real culprit is permitted to escape.—FRANK THONE.

#### CADMIUM-PLATED FOOD UTENSILS

WARNING against war-increased danger of acute poisoning from cadmium-plated food utensils, such as metal pitchers and refrigerator ice trays, appears in a report to the *Journal* of the American Medical Association by Dr. Samuel Frant and Irving Kleeman, of the New York City Health Department.

They report several outbreaks, involving about fifty people, of acute poisoning from small amounts of cadmium that got into iced drinks and frozen desserts from ice cube trays and a metal pitcher that had been replaced with cadmium. Fortunately, no one died, although all those who ate or drank the contaminated foods became violently ill within fifteen minutes after taking it.

The ice cube trays had not had any cadmium on them originally, according to the reports of the refrigerator manufacturers, but had apparently been coated with cadmium during reconditioning. In one outbreak, ice cubes for cooling punch had been made shortly after a leak of the refrigerant sulfur dioxide had been repaired. The sulfur dioxide dissolved in the water to give sulfurous acid which reacted with the cadmium to give cadmium sulfite. In other cases the cadmium got into the food from the action of acids in flavored crystals for making fruit drinks or in gelatin powders for frozen desserts.

Because of defense preparations, the plating industry is seeking substitutes for tin and other war-needed materials. Cadmium is not a suitable substitute in plating food utensils and the New York City sanitary code has already been amended to prohibit the use of cadmium in articles used in the preparation of food and drink.

#### ITEMS

For the first time, cases of endemic typhus fever have been reported in Ohio. Dr. George W. Stober, health officer of East Cleveland, will report one case in the forthcoming issue of *The Ohio State Medical Journal*, and the U. S. Public Health Service, which sent a representative from Washington to investigate, states that two other cases have been reported elsewhere in the state. Endemic typhus fever, which is spread by rat fleas, has been creeping slowly and steadily northward. Cases have previously been reported in central Tennessee. It is believed the Cleveland patient was bitten by a flea from a rat that had come from the South on a food truck or railroad car. European typhus fever, which occurs in epidemics, is transmitted by the human body louse.

A CHEMICAL from spoiled sweet clover may replace heparin, anti-blood clotting agent which has itself only been available for practical uses within the last two or three years, is reported by Dr. H. R. Butt, Dr. E. V. Allen and Dr. J. L. Bollman, of the Mayo Clinic at Rochester, Minn., as a result of first trials of the new chemical. The new anti-blood clotting substance is the chemical responsible for an often fatal bleeding disease of cattle that have eaten spoiled sweet clover. It is a coumarin compound which was isolated and prepared synthetically by Professor Karl Paul Link and associates at the University of Wisconsin. Advantages of the new remedy are its effectiveness when given by mouth, its prolonged action in lengthening the clotting time of the blood and its cheapness.

IMPORTANT hand-written documents blackened in fires started by the Nazi "Blitz" in London and other British cities are being deciphered by means of a photographic method described in *Nature*, proofsheets of which have been received. The method, which takes advantage of differences in reflecting power between the blank spaces and the lines of writing, was worked out by G. A. Jones, of the research laboratories of Kodak, Ltd., at Wellesbourne in Middlesex. As seen by the human eye, the sheets are uniformly black. However, under intense lighting with a narrow beam from a small arc lamp, the once-white surfaces become mirrors, photographing white, while the traces of the ink lines have little reflecting power and photograph black. It is necessary to press the blackened documents absolutely flat. Plates used in the camera had a special blue-sensitive emulsion, because of the high proportion of blue rays in the light from the arc. Mr. Jones's method is of particular value in England, where many documents of legal importance, such as title deeds, wills, ledger sheets, etc., are still hand-written.

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## SCIENCE NEWS

*Science Service, Washington, D. C.*

## PHOTOGRAPHY WITH INFRA-RED RAYS

SEVERAL years ago a group of executives visiting the research laboratory of a large photographic concern were photographed in the dark, with infra-red rays, which consist of waves too long to affect the eye. But now a special photoflash bulb will soon be placed on the market, to permit any photographer to take such pictures. The bulb is covered with a filter that looks black, because it stops all the visible light. However, the infra-red goes through freely.

Ordinary film will not work with this bulb, but infra-red sensitive film is now available from several manufacturers. As the rays are focused at a different plane from those used in ordinary photography, the focusing must be changed slightly if sharp pictures are to be secured. The most convenient way of using the new bulb is with a synchronizer that permits snapshots, the shutter being opened automatically while the flash is at its height. However, as with ordinary flash bulbs, the shutter of the camera, on a firm support, may be opened, the bulb fired, and then the shutter closed. This method is not effective in stopping rapid movement.

Photographs may be taken in theaters and similar places without disturbing the audience. Another use is seen in case of possible blackouts, where photography can be done without the visible flashes of light that might be of use to enemy raiders.

The new infra-red flash bulb is manufactured by the Wabash Photolamp Corporation, of Brooklyn, N. Y.

## CRUDE OIL RESERVES IN THE UNITED STATES

DESPITE the possible oil shortage in the eastern part of the country, on account of transportation difficulties, the crude-oil reserves of the United States, consisting of supplies "in sight or extractable by present methods and at approximately current prices reached a new peak on January 1."

This is reported in the Minerals Yearbook, shortly to be issued by the U. S. Bureau of Mines. At the beginning of 1941, according to the yearbook, quoting the American Petroleum Institute, the total reserve was 19,025,000,000 barrels, compared with 18,483,000,000 barrels a year before. At the present rate of use, this is a 13-year supply. During 1940, 1,894,000,000 barrels of reserves were discovered and developed.

Summarizing world production, the report says:

"The estimated world production of crude petroleum in 1940 was 2,149 million barrels—a gain of 70 million or 3.4 per cent. United States production rose from 61 per cent. of the world total in 1939 to 63 per cent. in 1940—a gain of 87 million barrels; production in the rest of the world declined 16 million barrels. Russia showed no substantial change, while output in Venezuela decreased 21 million barrels, in Iraq 5 million and in Rumania 3 million. Colombian production gained four million. Increased exports of crude and refined oils to the United States from Caribbean countries partly offset the loss of

their continental European markets and helped to maintain their crude output at a higher level than might have been expected.

"In the United States the new production of all oils increased by 91 million barrels, rising from 1,319 million in 1939 to 1,410 million in 1940. This output, however, exceeded demand, as indicated by an increase of 39 million barrels in the stocks of all oils compared to a decrease of 41 million in the stocks of all oils in 1939."

As usual, 1940 set a new record for domestic motor fuel demand, with 589,424,000 barrels, an increase of 6 per cent. over 1939. Even greater was the increase in fuel oil.

"The demand for fuel oil in 1939—a record up to that time—was far surpassed in 1940," it is stated. "A gain in exports and a decline in imports of fuel oil in 1939 were just reversed in 1940 when, owing to adverse international trade conditions, exports dropped sharply below the record volume of 1939, while imports, because of an unusual demand for heating oils in the opening months of the year and an expanding industrial program, were double the quantity received from foreign sources in 1939. The running of more crude to stills and a greater percentage yield brought about increased production of fuel oil in 1940 compared with 1939. A downward trend in stocks in 1939, which resulted in a shrinkage of 12 million barrels in the fuel-oil inventory for that year, was checked in 1940 when 6 million barrels were added to storage."

The demand for paraffin wax also established a new record in 1940. In fact, states the Yearbook, "Coke was the only major product of petroleum for which the domestic demand was lower in 1940 than in 1939."

## THE IMPORTANCE OF TIN TO THE UNITED STATES

IN the chapter on tin in the Yearbook it is pointed out that despite all efforts to accumulate a stockpile of this vitally necessary metal, the most optimistic estimate sets the supply now on hand at only a little over a year's normal consumption. While increased imports from Bolivia and other parts of the world will help, there is nowhere tin enough in sight wholly to replace the Indomalaysian supply should it be cut off.

Of the 169,500 long tons of tin used in the world last year, this country consumed nearly half—76,000 tons. Britain accounted for 32,000 tons, or nearly half of the remainder. This was substantially more than the combined tin utilization of the combined Axis powers, which totaled 26,500 tons. (The tons in these reckonings are long tons of 2,240 pounds, not the more familiar short ton of 2,000 pounds.)

Britain has long had a near-monopoly of tin smelting. In normal years about half of the world's supply has been smelted in British Malaya, and an additional quarter in the British Isles themselves. Most of the remaining fourth has been smelted in the Netherlands, the Netherlands Indies and China.

It has never been considered economically advisable to

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set up tin smelters in the United States, because the finished product could be purchased abroad more cheaply than it could be produced from imported ore in this country. Now, however, with a war emergency staring us in the face, one smelter has been contracted for, to be built at Texas City, near Galveston. It will be government-owned, but operated under contract by an American affiliate of one of the larger Dutch firms. Its cost is to be \$3,500,000, and its annual output 18,000 tons of refined tin.

Bolivia is the only important tin-producing country in the Western Hemisphere. The United States has contracted with several Bolivian mining concerns to purchase annually for the next five years sufficient ore to produce 18,000 tons of tin.—FRANK THONE.

### THE SHORTAGE OF SILK

SHORTAGE of silk for hosiery, which seems imminent with the freezing of Japanese assets, has resulted in many inquiries by the trade concerning the researches of the U. S. Government over the last few years on cotton for stockings.

This work has been done in the Research Center at Beltsville, Md., by the Textile Technology Division of the Bureau of Home Economics of the U. S. Department of Agriculture. A small textile plant has been set up on the grounds, where many different designs of cotton fabric for hosiery are being made up in swatches. Also, the division has made up 116 different styles of cotton stockings to show their appearance.

The effort has been to improve both appearance and the wearing qualities of the cotton hosiery, and at the same time add style, something which has not been done previously, according to David H. Young, of the Textile Technology Division. The new stockings are an answer to the objections of the public and the manufacturer that cotton hose get fuzzy, fade, wrinkle and wear poorly. The sheerest of hose can not be made of cotton, but in the service weight many designs and styles are available which compare most favorably with silk.

Much effort now is being expended in the preparation of a Dictionary of Cotton and Lisle Hosiery. This will ultimately include about 300 designs, of which 33 have been placed on exhibit in New York at the Cotton Textile Institute and Mercerizers' Association of America, where they can be examined by manufacturers.

Mr. Young said that 85 per cent. of the machines now used in making full-fashioned hosiery can be used for cotton with only minor adjustments. Thus, it should not take long for production to start when the silk supply is curtailed. With cotton, nylon and strong rayon, the hosiery situation can easily be handled despite the silk shortage.

The present nylon production is about 20 per cent. of that required for the entire full-fashioned stocking industry. This will be increased this winter with the completion of a new nylon plant in West Virginia. He expressed the belief that use of nylon in parachutes and for other defense purposes would not reduce this greatly, as there has been no let-up in the production for hosiery during recent months even though the government has bought large quantities for other uses.

### THE USE OF PECTIN IN SHELL SHOCK

THAT pectin, used in jelly-making, may be used as a substitute for blood to be transfused into the veins of war-wounded soldiers and civilians to save them from dying of shock, is proposed by Dr. F. W. Hartman and associates of the Henry Ford Hospital, Detroit, in a report appearing in the *Annals of Surgery*.

Tests on patients, guinea pigs, rabbits and dogs, conducted by Dr. Hartman, Dr. Victor Schelling, Dr. Henry N. Harkins and Dr. B. Brush, show that pectin solutions may be useful in treating shock and that they can be used safely.

The present war has reemphasized the urgent need for blood and blood plasma in the fluid or desiccated (dried) state, which may be used to combat shock and hemorrhage. Collection of dried blood plasma for American troops has been undertaken by the American Red Cross, but even with the largest drying units only 1,000 or 1,200 units of about half a pint each can be produced in a week. It is pointed out that from the standpoint of production alone, to say nothing of cost, transportation, storage and application, it seems obvious that some other substances which may be used as substitutes or supplements for blood and blood plasma must be found.

The primary need in cases of shock and hemorrhage is to replenish the volume of fluid circulating in the veins with a fluid which has identical or similar physical characteristics to the fluid part of the blood. The red blood cells in many cases are not needed and may even be undesirable. Isinglass (fish gelatin) and gum acacia solutions have been tried as blood substitutes but have not proved entirely satisfactory. Pectin solutions, properly prepared, have the necessary physical characteristics for transfusion into veins and they do not produce any damage as measured by tests of kidney and liver function.

Pectin, of course, is abundantly available at a nominal cost and the solutions for transfusion can be easily prepared. It shows promise as a remedy for shock, although so far it has been used chiefly as a substitute for blood transfusions to ward off shock from surgical operations in a small number of cases.—JANE STAFFORD.

### THE POSSIBILITY OF AN EPIDEMIC OF PLAGUE IN THE UNITED STATES

A WARNING that the United States may have a plague epidemic to combat is issued by the American Medical Association through an editorial in its journal published recently. While typhus is being held in check only with the greatest difficulty in Europe and may have reached epidemic proportions in Poland and the Balkans, the *Journal* states that "no doubt plague, as far as this country is concerned, is a problem of greater potentiality."

Plague is present on the Pacific coast, not as human cases, but in fleas of rats, ground squirrels and marmots. From these sources it is feared that the dread disease can spread to cause an epidemic in human beings when conditions become suitable.

Long-continued and careful plague control, involving ratproofing of buildings, trapping, poisoning and examinations of dead rodents, must be practiced in any area in which plague has appeared.

The consequences may be tragic if there is not a careful integration of the plague control activities of cities, counties, states and the Federal Government, with the use of trained personnel and the appropriation of adequate funds.

The four horsemen of the apocalypse—war, hunger, disease and death—travel with the increased speed of mechanized transportation. Sudden and wide-spread outbreaks of disease arising from hidden infections are more likely than ever. The insulation of this country from the disease consequences of war will prove a colossal task and will require the most careful planning and effort.

### THE ANTI-TYPHUS VACCINE

DR. R. E. DYER, assistant director of the National Institute of Health, and his colleague, Dr. N. H. Topping, left from Miami on August 2 for La Paz, Bolivia, to make an extensive, thorough trial of the anti-typhus fever vaccine on which the safety of British and American troops and even the outcome of the present war may depend.

The possibility that American troops may have to go into typhus fever regions of South America on hemisphere defense, as well as plans for aid to Britain which include supplying her with the typhus fever vaccine, make it imperative to know whether or not this vaccine works. Previous attempts to test the vaccine in European countries where typhus fever is a constant threat to life have failed because of the war abroad. Large batches of the vaccine, made according to the method originated by Dr. Herald R. Cox, of the U. S. National Institute of Health, were sent to Hungary, Rumania and Spain. Reports as to the results of the trials have either been inconclusive or have failed altogether to reach officials here. So the U. S. Public Health Service is going to make the tests itself under conditions that will leave no doubt about the results.

Enough vaccine for 5,000 persons has already been sent to Bolivia, where public health authorities and officials have promised full cooperation for the tests. The director of the state health department laboratory will probably work with Dr. Dyer and Dr. Topping.

These tests present one of the most difficult problems in disease-fighting. For each person vaccinated there must be one person unvaccinated who lives under exactly the same conditions as the vaccinated person, living in the same house, even sleeping in the same bed if possible, and thus equally exposed to the typhus fever germs which are spread by body lice.

The dangerous European type of louse-carried typhus fever, which kills from a fifth to about three fourths of those who get it, is always present in the highlands of Bolivia and certain other South American countries, often flaring up in disastrous epidemics. If an epidemic should break out in regions where Dr. Dyer and Dr. Topping have vaccinated half the population, they will have a quick answer on what the vaccine is worth, from comparing the number of cases, if any, among the vaccinated with the number among the unvaccinated. There is always so much typhus in Bolivia, however, that they will get an answer even without an epidemic. It will take longer, perhaps as long as nine months, Dr. Dyer said, but Bo-

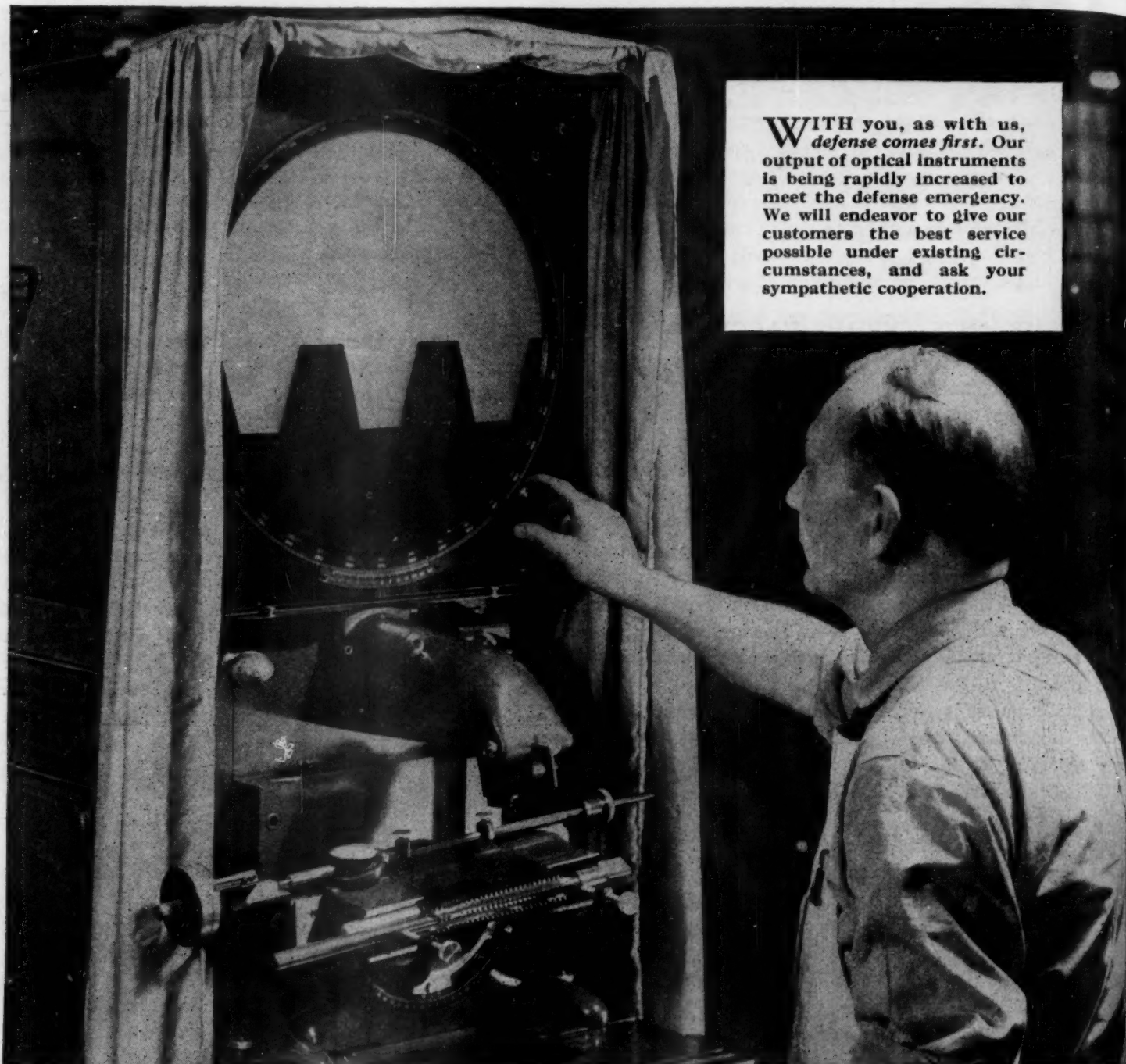
livia offers the best opportunity for field trials of the vaccine. It can not be tried in the United States, as we do not have any European type typhus fever here.

The Cox vaccine is the best of all those that have been prepared to fight typhus fever, according to the Public Health Service, because it has given the best results in animal protection tests and because it can be manufactured on a large scale. While Dr. Dyer thinks he will only need to vaccinate 5,000 people in Bolivia to determine its value, he can get vaccine for 100,000 should he need it.—JANE STAFFORD.

### ITEMS

THE wave of extreme heat that has ended in the East "presented an outstanding weather aspect of rare occurrence," the U. S. Weather Bureau states. It started in the Pacific Northwest and marched slowly and deliberately across the continent, taking a solid fortnight for the trip. Hundred-degree temperatures were reported in western Oregon on July 13, and the Virginia-Pennsylvania area saw the mercury hit the 100° mark on the twenty-eighth. There were heavy rains here and there during the heat, but the downpours were all local. In general, it has been dry, with crops in the great central agricultural region showing most effects. Corn has been damaged, but thus far not seriously. In the South, a let-up in the almost continuous rain has benefited cotton. Except in the South, what the country really needs is a spell of cool, wet weather.

THE common impression that the Irish have an unusually high birthrate, and that they are a "breeder nation," is erroneous, according to Dr. George F. Fitzgibbon, of Boston College. A number of factors have contributed to the creation of this impression, not the least of which is the high proportion of adults among Irish immigrants, and the preponderance of women over men. Among immigrants in general, about 80 to 85 per cent. of all arrivals are adults, but more than 99 per cent. of Irish immigrants were over fifteen years of age. And whereas men greatly outnumber women in other immigrant groups, among the Irish arrivals there were only seventy-four men to every one hundred women. It is true that Irish married women have large families, continued Dr. Fitzgibbon, but this high nuptial birthrate is offset by several other factors. The Irish have a tendency to marry late, many of them do not marry at all, and a rather high proportion of Irish marriages turn out to be childless. Furthermore, the high nuptial birthrate obtains only among the actual immigrants themselves; their American-born descendants have families little if at all larger than those of other Americans. At the other end of the picture, Dr. Fitzgibbon pointed out, there appears to be an abnormally high deathrate among the Irish in the United States. There are no national figures, but the deathrate among people of Irish descent was 23.6 in Pennsylvania and 20.5 in New York, at the time of the 1910 census. This is attributable to such causes as high proportion of immigrants over sixty years old, laborious and often dangerous occupations, and concentration in densely populated industrial areas.



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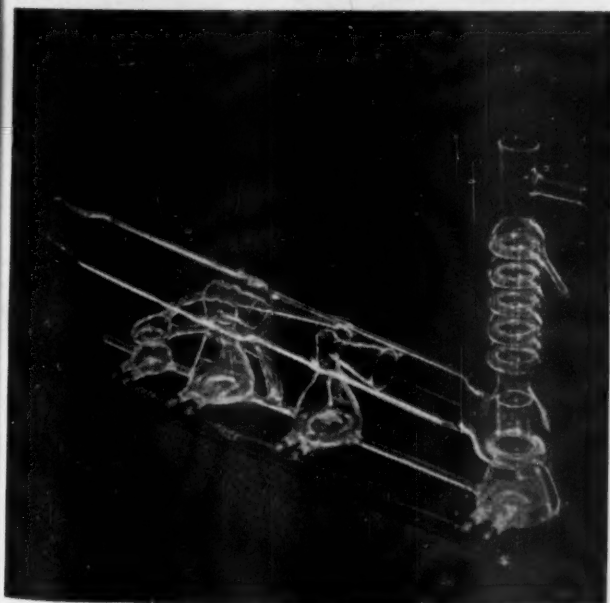
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## SCIENCE NEWS

Science Service, Washington, D. C.

## THE EXPLOSION OF STARS

THE conclusion that the sun will eventually explode seems a certainty, according to Dr. George Gamow, professor of physics at the George Washington University and one of the investigators who have helped astronomers to understand the alchemical process by which one element is changed into another to keep the sun and other stars fueled. However, this explosion, which will instantly convert the earth into a cloud of hot gas, is not likely to come soon, for Dr. Gamow assures us that it is not likely to happen for several billion years at least.

About twenty times a year astronomers, through their telescopes and occasionally with the naked eye, discover a "nova" or new star. Some of these are "super-novae," many times more brilliant than the common variety. Dr. Gamow thinks that the difference between the two kinds is merely one of the mass of the original star. "Whereas the explosion of such a giant star as Sirius," he says, in a report of his theory to *Popular Astronomy*, "would lead to a very brilliant supernova comparable with the 'star of Bethlehem,' the explosion of our own sun, which is known to be a middle-weight star, would be probably classed as an ordinary, common nova. This will make, however, but a very little difference for the population of the earth, since in both cases the increase of solar heat will be quite sufficient to turn our planet instantaneously into a cloud of hot gas!" With twenty novae a year, and our Milky Way system of stars about two billion years old some 40 billion stars in this system have already exploded. He estimates that there are between 40 and 80 billion stars in the system, so that "the chances of explosion for any individual star are fairly high."

It has been established, "beyond any doubt," according to Dr. Gamow, that transmutation of elements, for which the ancient alchemists sought in order to transfer base metals into gold, is the source of stellar energy. In the case of the sun, hydrogen is changed to inactive helium. Dr. Gamow's work has shown, paradoxically, that as the supply of hydrogen fuel is used up, the sun gets hotter, and the remaining fuel is burned faster. "When the solar hydrogen content drops from its present value of thirty-five per cent. down to one per cent. the sun will become about 100 times as bright as it is now." This will make rocks on the daytime side of the earth as hot as the kitchen stove, the oceans will boil, and human beings, if they have not been able to migrate to a more comfortable planet, will have to "spend most of their time in air-conditioned underground shelters. Fortunately enough the above described picture corresponds to a very distant future indeed, since the consumption of hydrogen and the increase of solar brightness are going on extremely slowly. It has been estimated, in fact, that the chemical reaction producing the radiation of the sun consumes about 0.000000001 (one-billionth) per cent. of solar hydrogen per century, so that it will be several billion years before this amount will be essentially changed before the sun will become hot enough to set the oceans boiling!"—JAMES STOKLEY.

## A NEW PROCESS OF MAKING LIQUID AIR

By making compressed air work as it expands, a new method of making liquid air has been developed by Professor P. Kapitza, of the Institute of Physical Problems of the Academy of Sciences of the U.S.S.R. in Moscow. A brief description of the process, based on a paper in a Russian journal, is printed in *Nature*.

All commonly used methods of refrigeration, whether in home refrigerators or machines for liquefying gases, make use of the same principle. This is that when a gas is compressed, it is heated; when the pressure is relaxed, it cools to about what it was at first. If it is compressed, then cooled, then decompressed, it drops to a temperature considerably below what it was originally.

Since the nitrogen making up most of the air has a boiling point (where it changes from liquid to gas) of 320 degrees below zero Fahrenheit, it must be cooled to this low temperature to liquefy it. This is done in several steps of compression, cooling and expansion, each one carrying it down some more. The Linde machine, widely used, uses pressures as high as 200 times that of the atmosphere.

It has been realized, however, that if, instead of merely allowing the gas to expand, it was made to do some work at the same time, still more energy would be removed from it, and the cooling would be still greater. Professor Kapitza has done this, by making the expanding gas drive a turbine. With this system the necessary cooling can be obtained with an initial pressure of only 5 atmospheres, instead of 200.

In the present Kapitza machine, the turbine revolves at 40,000 revolutions per minute. About 30 kilograms (66 pounds) of liquid air can be produced in an hour, using about 1.7 kilowatt hours of electricity in power for each kilogram. By utilizing the mechanical energy from the turbine, and with improved valves, it is thought that this may be reduced to 1.2 kilowatt hours per kilogram, about the same as with present machines using high pressures. Working on a larger scale, with smaller heat losses, Professor Kapitza expects to be able to make it still more efficient.

In any event, the writer points out, the Kapitza outfit has many advantages. It can be started in 20 minutes or less, is small in size, and does not need the many auxiliary attachments of the high pressure apparatus.

## THE SUPPLY OF CHLORINE

THE safety of your drinking water, your swimming pool and the cleanliness of the drink you obtain at a roadside stand are being protected despite the shortage of chlorine. Correspondence between Dr. Thomas Parran, Surgeon-General, and the Director of Priorities, E. R. Stettinius, Jr., shows that there is plenty of chlorine to take care of the needs of public health. The only danger to the supply for water works and sanitation seems to lie in an unfounded fear that a shortage will develop. Acting on this fear, some buyers are overstocking, thus tying

up containers. Lack of these containers may slow up the filling of new orders.

Public health uses of chlorine have been put on a par with defense needs by the Office of Price Administration and Civilian Supply. Adequate supplies are insured for water purification, sewage treatment, sanitation, refrigerant gases for existing equipment, slime control in industrial plants, preparation of products for medicinal use, preservation and processing of food products.

Not specifically mentioned in this provision is the use of chlorine by many soda fountains, roadside stands and bars for the sterilizing of dishes and glasses where steam or boiling water is not readily accessible. Chlorine is also widely used on dairy farms and city milk plants to kill bacteria in containers and to sterilize the hands of milkers and the udders of the cows before milking. For these purposes, a dry form of chlorine—sodium hypochlorite or calcium hypochlorite—is used, not the liquid chlorine commonly used as a bleach as well as a disinfectant. The OPACS is depending on distributors of this dry chlorine to see to it that these important public health needs are adequately filled.

Public health officials know of no substitute which will kill the germs and not endanger humans. They warn that without careful sterilization of milk containers, drinking glasses and dishes, there would certainly be a spread of many diseases carried in this way, including colds and influenza, tuberculosis, typhoid fever and paratyphoid fever, septic sore throat, diphtheria and scarlet fever.

Of the present production of chlorine, it is estimated that about 30 per cent. will go for defense. Only about 5 per cent. to 7 per cent. is needed for sanitation. It has been put up to the housewife, the laundry and the paper manufacturer, who use chlorine as a bleach, to cut down their use of chlorine so that neither public health nor defense uses need be curtailed.

### SLEEPING SICKNESS AND INFANTILE PARALYSIS

THE sleeping sickness (encephalitis) outbreak is spreading. Four states have reported cases to the U. S. Public Health Service in Washington.

In North Dakota, where the outbreak started, the cases were fewer for the week ending on August 2. There were 54 cases there as compared with 65 for the week ending July 26. But Minnesota reports 35 cases in that state. In South Dakota there were 19 and in Colorado, three. The cases in North Dakota were scattered generally throughout the whole state instead of being concentrated mostly in Cass County as they have been previously. Of the 54 North Dakota cases reported for the week ending August 2, only eight occurred in Cass County.

Infantile paralysis is also spreading. In the southern states, where the outbreak has been most serious, a decline in the number of cases is reported. But increases have been reported for New England, Maryland, New York, New Jersey, Pennsylvania, Ohio and Illinois.

New England had 16 cases during the week ending August 2, including four in Maine, five in Massachusetts, one in Rhode Island and six in Connecticut. In the previous week there were only four cases—two in Massachu-

setts and two in Connecticut. Before that there had been none. Maryland had 14 cases, as compared with three the previous week, and of these nine were in the city of Baltimore. In Pennsylvania, the number climbed from eight to 15; New York from 11 to 12, and New Jersey from two to five. Ohio reported an increase from 11 to 16; Illinois from four to 13, and Michigan from seven to eight. Indiana had a decrease from eight to five. California, which has been having a small number of infantile paralysis cases right along, reported a decrease from nine cases in the week ending July 26 to eight for the week of August 2.

The total number of infantile paralysis cases for the week ending August 2 was 326 as compared with 302 for the previous week. The increases in the North more than offset the declines in southern states. In Alabama and Georgia, where cases have been most numerous, cases have dropped from 58 (in Alabama) and 79 (Georgia) to 49 and 71. Tennessee reported a decline from 24 to 13 and Kentucky from 11 to seven.

### VITAMIN B<sub>1</sub> IN THE BUDS OF TREES

LARGE quantities of vitamin B<sub>1</sub>, the "morale vitamin" which exercises a beneficial effect on the human nervous system, have been found in the buds and leaves of many common American trees by Yale University botanists.

Using a constant temperature tissue culture laboratory for experiments, heavy concentrations of the substance were found in the buds of oak, red maple, horse chestnut, elm, sycamore and white pine trees. "Although vitamin B<sub>1</sub> is now produced by synthetic chemical processes, this discovery points to a large natural source of vitamin B<sub>1</sub>," according to Professor Paul R. Burkholder. "This finding may offer a clue to the source of essential vitamins for many forest animals."

Professor Burkholder, who is conducting his researches in cooperation with Professor Edmund W. Sinnott, states that the vitamin seems to be formed in the young leaves and growing points of the shoot, whence it is transported through the bark into the roots and various portions of the plant.

Experiments in which basswood and maple trees were girdled, by removing a ring of bark from the trunk early in the spring, show that almost no vitamin B<sub>1</sub> has appeared below the ring in mid-summer. Yet huge quantities of the vitamin have been found above the ring. This seems to indicate that ultimately a girdled tree may die not only from lack of food but from vitamin starvation as well.

These researches show that most green plants contain sufficient amounts of the vitamin for their normal growth. The amount of essential minerals in the soil and sunlight apparently influence the amount of B<sub>1</sub> which green plants are able to produce. Vitamin B<sub>1</sub> is heavily concentrated in the buds of trees just as it is in grain. Recently, flour refiners have sought to increase the vitamin content of flour by restoring B<sub>1</sub> after refining has taken place in order to provide more of the material for the nation's health.

The amount of B<sub>1</sub> is measured by the amount of growth of a mold which is very sensitive and is used as an indi-

eator plant. Growth of the indicator plant will not take place unless vitamin B<sub>1</sub> is added, and the amount of growth varies directly with the supply of vitamins.

### HAY FEVER

ALL allergy, like all Gaul, may be divided into three parts—three, because of the three principal avenues of entrance or points of attack. Allergic poisons may, in the form of cosmetics, chemicals or plant juices, penetrate the skin of the hands, face or other parts of the body and thus assault us from without. They may be swallowed, as food, and subsequently snipe at us from within. But the most common and most insidious offenders are those invisible enemies that pounce upon us from the air. They find our most vulnerable spots—the tender membranes that cover the eyeballs, and those that line the eyelids, the nasal cavities and the lungs.

With reasonable care we may usually succeed in avoiding unfriendly food and chemicals. But the aerial allergy attack by pollen grains, mold spores and buoyant insect scales is so wide-spread, so intense and long drawn out, that special personal defense measures must be taken. Nevertheless, a certain grim satisfaction may be had from the fact that there are few surprise attacks. All the major allergenic broadsides are loosed on well-developed schedules.

Over the northern and eastern states the blossoming dates are well synchronized, but in the south central and southern states the weeds usually come to maturity later than in the north. However, there are a few interesting local exceptions. The Arizona ragweed season occurs in the spring—March and April—instead of August and September. In southern Florida, on land where winter tomatoes and other vegetables are grown, common ragweed comes into full bloom in May. Wyoming has a small amount of ragweed pollen in the air in June and July. Along the Gulf Coast, from Tampa to Brownsville, ragweed pollination begins in September and drags along well into November.

If one were anxious to follow ragweed around the calendar and the map he could keep in close touch with it about nine months out of the year. He could dodge it almost completely by staying in Houston until about the last week of September and then changing his residence to some northern city. A non-stop flight from Houston to Minneapolis by plane at 10,000 feet altitude would do the trick.

Spores of certain kinds of fungi, principally molds, cause hay fever and asthma in just the same way as pollen, but not necessarily in the same persons. One man may be sensitive to certain pollens only, another to mold spores but not pollen, and still another to both pollens and spores.

It is possible to prevent the symptoms caused by mold spores. The skin testing and treatment are carried out in the same way and produce the same degree of benefit as pollen treatment. A graduated series of hypodermic injections brings the patient's tolerance to a high level before the season begins and the treatment is continued at regular intervals to keep up the tolerance through the season.—OREN C. DURHAM.

### ITEMS

GREAT activity on the sun, with one spot big enough to be seen with the naked eye, through dark glass, was reported by the U. S. Naval Observatory in Washington. As a result, it is possible that in the next few days there will be magnetic disturbances on earth, and perhaps radio communication across the oceans may be affected. For Saturday, July 26, the Naval Observatory astronomers said, there were 96 spots in seven groups, which covered a total area of 43 square degrees. This is an unusually large number for this time, several years past the time of maximum sun-spots, which vary over an eleven-year cycle. Observers at the U. S. Coast and Geodetic Survey's magnetic observatory at Cheltenham, Md., stated that no unusual magnetic activity had yet been observed.

THE newest weapon that will be speeding across country to fight infantile paralysis outbreaks this summer, along with "iron lungs," splints and the like, is the laboratory on wheels of the School of Public Health of the University of Michigan. It will go to communities having no laboratory facilities, where infantile paralysis outbreaks frequently occur, and will be used to collect specimens needed in the search for a means of preventing or curing the crippling malady.

LIGHTWEIGHT radio sets are used in ever-increasing numbers by the rangers and fire-fighters of the U. S. Forest Service. The smallest and most compact is a set weighing less than six pounds and taking up about as much space as three quarters of a loaf of bread. This set is carried by parachute-jumping fire-fighters, who can talk to the plane that drops them or to headquarters. Longer-ranged and capable of standing rougher treatment is a short-wave set weighing 21 pounds, with a working range of 20 miles. Sets of this type will be used by a mapping expedition of the American Geographical Society. Some of them will be dropped with supplies by parachute in wilderness areas which the ground crew may not reach for several weeks. In the meantime the sets may have to withstand rough handling by inquisitive bears.

THE bright star Arcturus, which passed almost directly overhead in June evenings, "is representative of a class of fairly numerous stars, known as K giants, which differ in many ways from the normal, or dwarf stars, like the sun," said Dr. Gustaf Stromberg, of the Mount Wilson Observatory, before a session of the Astronomical Society of the Pacific. They are rather large, having diameters from 10 to 50 times that of the sun and their intrinsic brightnesses are equivalent to from 50 to 500 suns. They are much redder than the sun and therefore have considerably cooler atmospheres. The mechanism by which they generate heat must be quite different from that activating the sun and other normal stars and their evolution may well have followed different lines. They are not in general found in star clusters in or outside the galactic system and seem to be peculiar to our own system, or even perhaps to that part of the system in which we are at the present time. They are quite distinct from the so-called supergiants, which are found in star clusters.

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## SCIENCE NEWS

Science Service, Washington, D. C.

## BEYOND URANIUM

THE possibility of a group of elements resembling the rare earths beyond uranium or element No. 92, once considered the uttermost outpost of the atomic system, has been demonstrated mathematically by Dr. M. Goeppert Mayer, of Columbia University, and is reported in the forthcoming issue of the *Physical Review*.

The uranium outpost was passed some years ago by Professor Enrico Fermi, Nobelist now working at Columbia University, but then in Italy, with his discovery of the radioactive element No. 93, now called neptunium. Since then several other radioactive "transuranic" elements have been discovered by experimental research.

The chemical behavior of element No. 93 was determined in 1939 and 1940 by Dr. E. McMillan and Dr. P. H. Abelson at the University of California, who came to the conclusion that it was a rare earth and suggested that a second rare earth group might start at uranium. This is precisely what Dr. Mayer has proved to be mathematically possible. The problem had been previously discussed by Dr. H. C. Urey, of Columbia University, and Dr. Y. Sugiura, Danish chemist, on the basis of the old quantum theory. Dr. Mayer, using the newest quantum theory, has come to more definite results.

The group of rare earths occupies a quite anomalous position in the chemist's "periodic table" of the elements. This table classifies the elements into families having similar chemical properties, but also individual differences from the type, i.e., family resemblances and differences. Each element, except those belonging to the rare earth group, occupies a separate box to which belongs a certain group of chemical properties.

The rare earths consist of fifteen elements belonging to the aluminum family. Their chemical properties are so similar that it is extremely difficult and sometimes impossible to separate them by chemical means. It is as though in a family, after a number of single births, suddenly a litter of fifteen almost identical sons appeared. In the periodic table there is only one box reserved for the particular set of chemical properties shared by these fifteen elements. So, all of them had to be crowded into this one box.

This curious situation is fully accounted for by Dr. Mayer's formulas. Her researches also show that the same conditions that cause it recur in the neighborhood of the uranium atom. Hence it is quite possible that a similar series of elements, almost identical in their chemical properties, exists in the transuranic region.

## DETERIORATION OF PHOTOGRAPHIC FILMS

THAT the deterioration of photographic films and plates with time, which requires an early development after exposure, is not due to cosmic rays, is shown by experiments of Wayne T. Sproull, of the General Motors Research Laboratories in Detroit.

If the deterioration is principally due to cosmic ray

action, then it should be shown more markedly by film manufactured expressly for use with x-rays, and therefore more sensitive also to cosmic rays, than by ordinary film. The effect shows itself principally as a general fogging of the film. The cosmic rays, which pour down continuously upon the earth and penetrate whatever wrappings or coverings protect the film, would be capable of such an effect.

In 1939 Mr. Sproull purchased some Eastman "Verichrome" film and some Agfa x-ray film. One half of each type of film was stored in a mine shaft 2,057 feet below the surface of the ground where measurements by V. C. Wilson had previously shown that the cosmic ray intensity was about one twenty-thousandth of that on top of the ground. The remaining films were stored in an ordinary place in Detroit.

Two years later (1941) some of the mine-stored x-ray films were developed along with some of the x-ray films stored in Detroit, and a piece of new Agfa film. The films were developed and fixed together. The new film of course showed no fogging, but the other two were about equally fogged, showing that the cosmic rays were not a major factor in this deterioration. Similar tests with the Verichrome film gave similar results.

If the cosmic rays were a major factor in film deterioration, the author states, there would be little prospect that a way could ever be found to prevent such deterioration. But since it appears to be due to temperature and humidity effect, there is still hope that a remedy will eventually be found.

## MAGNESIUM

MAGNESIUM, the white metal important in defense and warfare because of the lightness of its alloys, as well as its use in incendiary bombs, may be made easily from many common ores with a new process. This is claimed in the specifications accompanying U. S. Patent 2,251,968, which has been granted for the method to the inventor, Carlo Adamoli, of Milan, Italy. Rights on the American patent are assigned to the Perosa Corporation of Wilmington, Delaware.

Present methods of preparing the metal use electrical means in separating it from its compounds, but these are not used in the Adamoli process. From common magnesium-containing ores, such as talc, magnesite, dolomite, etc., is obtained metal which, quoting the patent, "is free from any impurity having its origin either in the ores or in the reagents which have been used, the process being performed in the course of a single direct operation and avoiding the losses of metal which are ordinarily incurred when it is necessary to melt the metal because it is not compact enough."

The process is a cyclic one, in which the material goes through again and again. The ores are mixed with hydrofluoric acid to form magnesium fluoride, a reducing agent is mixed with them, and the magnesium metal goes off in a vapor, to be condensed to the solid form. Then the

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hydrofluoric acid is regenerated and mixed with more of the ores.—JAMES STOKLEY.

### AMERICAN DRUG PLANTS

AMERICAN drug plants are being studied as possible replacements for similar drugs that used to be imported but are now cut off, or at least threatened, by the war, according to papers read before the American Pharmaceutical Association. In some instances, satisfactory replacement plants are already in sight.

Ergot, a powerful drug used in checking bleeding after childbirth, can be produced in as high quality from American-grown material as it can from the Spanish imports, it is indicated in tests reported by H. W. Youngken, Jr., E. B. Fischer and Dr. C. H. Rogers, of the University of Minnesota.

Ergot is a parasitic fungus that preys upon grain. The part used in medicine is the hard, purple fruiting body, shaped like an exaggerated wheat or rye grain, that protrudes from the heads of diseased plants. These fruiting bodies are harvested by hand, and the active principle, an alkaloid known as ergotoxine, is extracted from them. The studies indicate that American rye ergot yields more of the essential alkaloid than Spanish rye ergot, but that ergot from American wheat is less rich in ergotoxine than the Spanish rye material.

Imported capsicum, source of an exceedingly hot drug used externally in liniments and plasters and internally as a medicine in digestive disturbances, can be replaced by domestic tabasco peppers, was reported by Miss Carmel R. Olden and Professor E. V. Lynn, of the Massachusetts College of Pharmacy. In preparing the familiar condiment, tabasco sauce, the seeds and hulls of the peppers are commonly discarded, yet these wastes are as rich in the essential principle, capsaicine, as any other part of the plant. It is proposed that tabasco peppers replace imported capsicum as the official source of the drug, because the latter is now difficult to obtain and apparently offers no advantage in medicine.

Strychnine from American-grown sources is a possibility suggested to the meeting by Dale L. Kinsely, of North Dakota Agricultural College. Strychnine is extracted from shrubby plants of the genus *Strychnos*, one species of which, *Strychnos spinosa*, has been grown successfully in Florida since 1903. Mr. Kinsely's researches have been directed to both the botany and the chemistry of this plant.

### INFANTILE PARALYSIS AND ENCEPHALITIS

INFANTILE paralysis is still on the increase, but, except in the South, the situation is not any more alarming than it has been in recent weeks, according to reports received by the U. S. Public Health Service.

Southern states, which have been having large numbers of cases in previous weeks, are still having them. Alabama, hardest hit by the disease, reports a jump from 49 cases, for the week ending August 2, up to 80 for August 9. In Georgia, the number of new cases remains the same, 71. Four other southern states report increases: Tennessee, from 13 to 31; Kentucky, from 7 to 13; North Caro-

lina, from 0 to 10, and South Carolina, from 5 to 16. In Florida, the number went down from 27 to 13.

Minnesota is suffering the double trouble of a sleeping sickness (encephalitis) outbreak and infantile paralysis. The infantile paralysis cases jumped in the week ending August 9 from 3 cases to 12. Many more victims were claimed in Minnesota by sleeping sickness, which has crossed the river from neighboring North Dakota. These cases nearly doubled in number in the week ending August 9. The jump was from 35 to 65. Colorado also reports an increase in sleeping sickness from 3 cases to 9.

In states in the east central part of the country, infantile paralysis cases are increasing, but the situation there is not as bad as it is in the South. New York reports an increase from 12 to 30 cases; New Jersey, from 5 to 13; Pennsylvania, from 15 to 17; Ohio, 16 to 27; Indiana, 5 to 12, and Michigan, 8 to 10.

In New England, where slight increases during the week ending August 2 led health officials to fear the outbreak might be spreading, reports were reassuring. A total of only 7 cases were reported for this whole region for the week of August 9, as compared with 16 for the previous week.

### CONTROL OF THE RED SCALE

RED SCALE, an insect rated as number one pest of citrus groves, has seriously threatened our chief source of vitamin C, yet no control methods have been successful against the pest.

To-day, however, the University of California Citrus Experiment Station announced a sure death for red scale: an insect imported from South China that hunts and devours the citrus pest. J. Linsley Gressitt, graduate of the university, now at Lingnan University, went to China at the request of the Citrus Experiment Station and collected the pest killers.

The insects rode a clipper plane from Hong Kong to San Francisco, then were sent directly to the United States Department of Agriculture insectary at Hoboken, New Jersey, to be tested as "carriers" of tree disease. When no evidence of citrus canker was found in the shipment, the insects were sent to California for trial as red scale predators.

The Chinese insects successfully cleared laboratory test trees of the scale. Orchard tests of from two to four years will be necessary to check the laboratory experiments, and large numbers of the insects have been raised for release in southern California citrus groves. If normal orchard conditions do not limit their effectiveness, one of the greatest problems of Western citrus growers will be solved.

Sprays and fumigation, costly and sometimes harmful to trees, have been of little help in the war against red scale in recent years. If the Chinese immigrant predator is as effective in orchards as in the laboratory, hundreds of thousands of dollars now spent on other controls will be saved by the living, self-propagating insect control, and bigger and better crops of citrus fruits will be harvested.

Harold Compere, Dr. Stanley Flanders and Dr. H. S. Smith, of the Station Staff, have conducted the experiments.

## POISON FOR SILVERFISH

SILVERFISH, the long, grayish insects that scamper through stored books, papers and linens, have had their private lives examined and their death warrant written. The likes and dislikes of these elusive pests that destroy valuable papers, books and heirlooms have been discovered by Arnold Mallis, entomologist of the University of California at Los Angeles.

The species used by Mr. Mallis in his studies, called *Ctenolepisma urbani* by entomologists, is unable to survive a spray of pyrethrum. When the silverfish is confined in a pyrethrum dust it shows great signs of irritation, often within thirty seconds. The pyrethrum dust adheres to the hairs on the body and around the mouth parts as well as upon all appendages. The insect becomes paralyzed within from three to ten minutes.

Sodium fluoride and sodium fluosilicate have been used in the past to control silverfish but were only partially effective. If these poisons are combined with pyrethrum, the lethal result to the pests is greatly enhanced. Treated "cards" sold commercially for silverfish control have little effect on the pests.

The diet preference of silverfish was also studied, and it was found that animal fibers such as silk and wool are not as popular with the pests as vegetable fibers, linen, rayon, cotton and lisle. As all paper and fine old linens are made from vegetable fiber sources, this explains their choice of libraries and linen closets for habitation. The insects are very fond of Cellophane, Kleenex and onion-skin paper, preferring these materials to newsprint and cardboard.

## MAHOGANY A TIMBER CROP FOR FLORIDA

MAHOGANY may some day be a money-making timber crop in southern Florida, according to Professor Frank E. Egler, of the New York State College of Forestry.

The southern part of the peninsula, he points out, is similar in climate and other ecological conditions to the West Indian Islands where one species of mahogany flourishes. Mahogany trees are planted along the streets in some Florida cities and they are also found growing wild in the "hammocks" or hardwood groves that dot the flat Florida landscape. West Indian mahogany trees grow fairly rapidly under Florida conditions. Two-year-old saplings planted at Coral Gables in 1935 were 25 feet high in 1940. They are also more resistant to cold than might be expected of tropical trees, for they came through the severe freeze of the winter of 1940 that killed many other tropical plants in southern Florida. Mahogany trees will grow in a wide variety of habitats, from dry and exposed to semi-shaded and wet. They do, however, need protection from fire, a too-common and tolerated woodland evil in Florida.

Professor Egler, in a communication published in the August issue of the *Journal of Forestry*, indicates an increasing need to take thought for future mahogany supplies. The United States, with an annual utilization of about 24 million board feet, imports four fifths to nine tenths of the world's total cut. And since mahogany

cutters in tropical lands naturally take the trees nearest available transportation routes (usually rivers) it is becoming increasingly difficult and expensive to bring mahogany logs to market.

## ITEMS

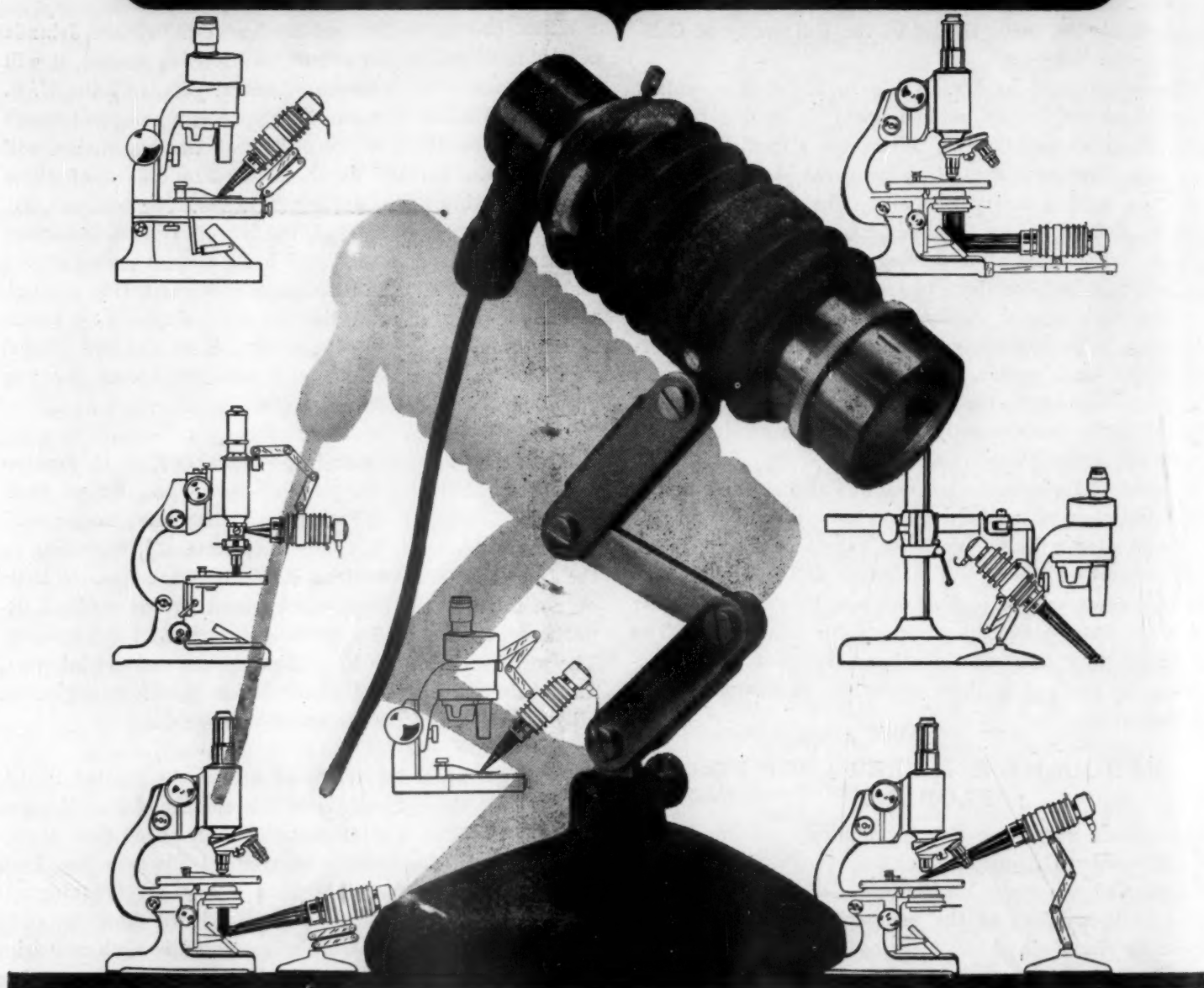
WHEN the great fur seal herd of the Pribilof Islands next puts to sea, at the end of its breeding season, it will be accompanied by a group of investigators of the U. S. Fish and Wildlife Service, in a specially equipped vessel now being outfitted. The object of the expedition will be to obtain further data on the life habits of these highly valuable animals for use in their protection. By international treaty in 1911, the United States undertook the supervision of the Pribilof herd, largest group of fur seals in the world, then threatened with extinction through reckless hunting at sea. Last October, Japan gave notice of intention to abrogate the treaty, which she had a legal right to do, but stated at the same time that she was prepared to conclude a new agreement.

MORE than a million dollars—\$1,192,000, to be exact—will be spent during the coming twelve months on anti-mosquito defense in and around the fifty-three major military areas where U. S. troops are quartered, according to the *Journal of the American Medical Association*. A little over a third of this sum will be used by the medical department, the remainder by the quartermaster department. The work will be done by civilian specialists and laborers, under the direction of eighty-seven sanitary engineers, all of them mosquito eradication experts.

IN preparation for whatever action the United States may take in the current Latin American and Far Eastern disturbances, the War Department announced that a special course of instruction in tropical diseases has been organized at the Army Medical School in Washington. Physicians taking the course will learn how to fight cholera and leprosy that are wide-spread in such countries as China; bejel, a non-venereal form of syphilis occurring among the Arabs of the middle Euphrates Valley; pinta, the spotted sickness of Mexico and other tropical countries; Oroya fever, an infectious disease found in Peru; and "Q" fever, a new disease found first in Australia.

IN experiments conducted at the Rockefeller Institute for Medical Research in Princeton by Dr. Folke Johnson, dodder, the pale yellow, leafless, parasitic vine that preys on the stems of other plants by sinking root-like growths into them, has been proved guilty of carrying virus diseases from one plant to another. Dodder shares with other non-parasitic vines the habit of twining around one stem for a distance, then reaching over to a neighboring stem. The living bridge thus formed sufficed to carry the viruses from infected to uninfected plants, under controlled laboratory conditions. Among the virus diseases thus transmitted by dodder were aster yellows, bushy-stunt of tomatoes, tobacco mosaic, curly-top of sugar beets and cucumber mosaic. Dr. Johnson reports his discovery in the current issue of *Phytopathology*.

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## SCIENCE NEWS

*Science Service, Washington, D. C.*

## VAN GENT'S COMET

A COMET bright enough to be seen with the naked eye is now in the northern sky.

Van Gent's comet, named after the astronomer at the Johannesburg Observatory in South Africa who discovered it in May, is now well above the sixth magnitude, the faintest at which a star, under best conditions, can be seen without the aid of a telescope. A comet is a little harder to see, because, unlike a star, its light is diffuse, and is not concentrated in a point.

During the end of August and early September, Van Gent's comet, according to a schedule prepared by Dr. George Van Biesbroeck, of the Yerkes Observatory, reaches its brightest, with magnitude 4.8. By mid-September it will be drawing away from the sun, though it will come closer to the earth, and will be fainter. But even in early October it will be of magnitude 5.6, still above the naked eye limit.

If you want to see this comet you should look to the northwest as soon as it gets dark. You can easily, if it is clear, find the big dipper, part of Ursa Major, the great bear. Around September 1, the comet will be directly under the end of the dipper's handle, which extends to the left. Unfortunately, about this time, the moon, full on September 5, will be very bright and add to the difficulties. The moon reaches last quarter, when it does not rise until about eleven o'clock, on September 13, and then the comet will still be nearly as bright as a week or two earlier.

In the glare of a large city, and with the smoke and dust usually surrounding such an area, it will probably not be possible to see the comet, at least not with the naked eye. However, if you use a pair of binoculars, and look carefully at the region indicated, you may be able to find it. And if you are able to get away from the city to a place where there is a clear northern sky, the binoculars will also help you to find it. Then you can probably pick it up without the glasses.

Van Gent's comet has a short tail, points upwards, since all comet tails point away from the sun. The tail consists of fine dust gases which are discharged from the nucleus as it approaches the sun. Because these weigh so little, they are actually pushed by the pressure of light from the sun, just as wind pushes smoke from a locomotive as it moves along.—JAMES STOKLEY.

## ENCEPHALITIS, INFANTILE PARALYSIS AND PLAGUE

THE encephalitis outbreak is gaining ground rapidly in North Dakota and Minnesota, according to reports received by the U. S. Public Health Service. In North Dakota, new cases reported for the week ending August 16 had mounted to 340 as compared with 178 the previous week. Another potential danger in this state is seen by health officials in an outbreak of sylvatic plague found in fleas from ground squirrels. This disease has been known to spread to human victims.

Minnesota, doubly troubled with both sleeping sickness and infantile paralysis, reported 121 cases of sleeping sickness as against 65 the previous week, and an increase from 12 to 14 cases of infantile paralysis.

In neighboring Manitoba, across the Canadian border from North Dakota and Minnesota, 22 sleeping sickness cases have been reported as occurring recently. This region had previously reported an outbreak of infantile paralysis. Health officials think that there may be some significance in the doubling up of infantile paralysis and sleeping sickness there and in Minnesota. The two diseases are similar in some ways; both affect the nervous system. It is possible it may be discovered that both can be acquired from the same or related sources.

In South Dakota the number of sleeping sickness cases went down from 61 to 44.

Reports from various parts of the nation of infantile paralysis cases show the same rate of increase for the week ending August 16 as during the previous week. Although the percentage increase remained the same, the actual number was larger, however. The jump was from 422 for the week ending August 9 to 549 in the week ending August 16, exclusive of West Virginia which has not yet reported. Figures for the week of August 2 were 326. This means an increase of 127 cases for the week ending August 16 compared with an increase of 96 cases for the week before—just about 30 per cent. in both periods.

The largest number of cases are still concentrated in the south Atlantic and east south central states where Alabama reported 82, Tennessee 37, Kentucky 15, Georgia 69, North Carolina 16, South Carolina 11, Maryland 16 and the District of Columbia 8. Increases were not very large there, however.

Most significant increases were in New England where the number jumped from 7 to 22, in New York with an increase from 30 to 49, Pennsylvania from 17 to 45, Ohio from 27 to 37, Illinois from 8 to 18, Michigan from 10 to 16 and Wisconsin from 1 to 5. Iowa reported five cases and Missouri four. Neither of these two states had cases in the previous week.

A case of plague in a human victim has been reported by California health authorities to the U. S. Public Health Service in Washington. This report follows closely on a warning issued by the American Medical Association that war conditions might cause a frightful epidemic of plague to sweep the United States. Plague is prevalent on the Pacific Coast in fleas, rats, ground squirrels and marmots. Recently it was reported spread to North Dakota in the fleas that infest squirrels there.

The last outbreaks of plague in a Pacific Coast port occurred in Los Angeles in 1924. During that epidemic there were 32 cases of pneumonic plague with 30 deaths and 7 cases of bubonic plague with four deaths.

## THE JAPANESE BEETLE

JAPANESE beetle, one of the most alarming insect pests that ever invaded America, shows signs of "settling

down" and becoming only a "normal" nuisance instead of a veritable scourge. Evidences pointing in this direction have been turned up by entomologists working at the New Jersey Agricultural Experiment Station at New Brunswick.

Maps of the distribution of the beetle, made in successive years, show that infestation is always worst in newly invaded territory. The first map, made when only northern New Jersey was afflicted, shows a limited area, all black. The next map, showing conditions after the active spread had begun, shows a lighter infestation in the original area, with the black of severe infestation in the newly occupied regions. At present, the map is black from Washington, D. C., southward into Virginia, with the black frontier on the west well out into Pennsylvania.

The principal reason for this lessening of severity appears to be the overtaking of the beetles, especially in the larval stage, by their natural enemies—the phenomenon known as biological control. This arises partly in the course of nature, but it is assiduously promoted by Federal and State entomologists.

Most promising of biological controls thus far found are the bacteria that cause the "milky disease" of the beetle's larvae or grubs. It wipes them out by billions, greatly reducing the infestation where it is prevalent.

Entomologists carefully inoculate large numbers of grubs and after they are thoroughly riddled with the disease dry their bodies and grind them up into a white powder containing vast numbers of bacterial spores. They plant quantities of this powder in heavily infested areas, and let natural distribution take care of the rest.

One of the latest discoveries in this field, made by workers in the U. S. Department of Agriculture, is that adult female beetles, which are themselves not subject to milky disease, may serve as distributing agents. They come to maturity under ground, like June beetles. As they crawl to the surface, bacteria present in the soil may cling to their bodies. Then, when they alight later on to lay their eggs, they unwittingly provide for the destruction of their own offspring by shedding some of the bacteria that they have been carrying.—FRANK THONE.

### ITEMS

ASTRONOMERS have discovered a new object in the heavens and telescopes, particularly in the southern hemisphere, are keeping track of it to find out whether or not it is a new comet. It was first discovered by astronomer Dutoit at the southern station of Harvard University, at Bloemfontein, South Africa, on July 18, and later independently observed on July 25 by astronomer Neujmin at Simeis Observatory in the Crimea. The object is now 9th magnitude, too faint to be seen without a telescope. It is in the vicinity of the constellation of Aquila, the eagle. More observations will be needed to determine whether it is a comet and whether it will become visible to the unaided eye.

THE moment a thunderstorm threatens, get into the house, preferably into a large house. This is the ad-

vice of Dr. P. L. Bellaschi, in charge of the Sharon high voltage laboratory of the Westinghouse Electric and Manufacturing Company, who has dealt with more than 400,000 strokes of artificial lightning and reviewed the case histories of more than 100 deaths by natural lightning. In the house choose a spot near the center of the room. Stay away from windows, open doors, stoves, pipes, chimney and fireplace. The most dangerous place to be is out in the open. About 90 per cent. of lightning casualties occur in the rural districts. If no large barn or farmhouse is in sight, do not make for a shed, booth or small open barn. Keep away from tall isolated trees, wire fences, poles, pipes, tractors and other metal objects. Get away from beaches, swimming pools and fishing ponds. Make for depressions, valleys or dense woods. If you are in your car, it is the safest place. Recently, Dr. Gilbert D. McCann, in charge of Westinghouse lightning studies at East Pittsburgh, sat in a steel-topped sedan while bolts of 3,000,000 volts artificial lightning repeatedly struck the top. Steel-topped busses and trains are equally safe.

TEAR gas (chloropierin) makes the soil safe for watermelons in parts of the country, especially the South, where the destructive eelworm pest has practically wiped out watermelon culture, has been discovered by investigators in the U. S. Department of Agriculture. Chloropierin has been known for some time as an effective soil disinfectant, killing some kinds of weed seeds as well as worms, earth-dwelling insects, etc. It has been used by greenhouse men, but its cost places it out of the question for the large masses of soil in outdoor fields and gardens. Eelworms travel at the modest rate of an inch a month. Hence, if the spots where watermelon hills are to be located are given a sufficient injection of the tear gas to clean out the area that is going to be occupied by the watermelon roots, the crop can be grown and harvested safely.

FULL color prints can now be made from the usual Kodachrome transparencies. This has been the desire and dream of camera users ever since the introduction of the Kodachrome process in 1936. These prints for amateurs are enlarged from either 35 millimeter or bantam-size Kodachrome transparencies. Enlargements of twice and five times original size are available. The minicolor print feels like a fine playing card. However, the print support or base is not paper or card but pigmented cellulose acetate, the material of which safety films are made. The prints are doubly varnished; hence they are very durable and can be carried in the pocket without injury. Professional grade prints are offered, under the trade name "Kotavachrome." These can be had in sizes up to 30 by 40 inches, a size never before successfully obtained in full color prints. The Eastman Kodak Company states that while the dyes used in these color prints are as stable as possible, consistent with their other requirements, they can not be guaranteed not to change. The prints, they say, should not be exposed for long to direct sunlight. At present both the amateur and the professional prints are made at Rochester.

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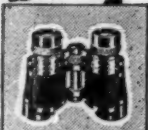
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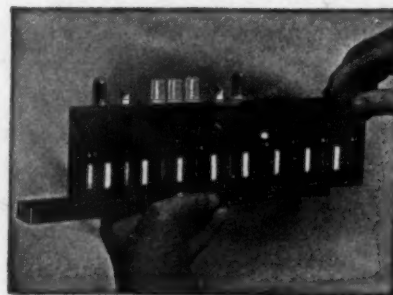
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## SCIENCE NEWS

Science Service, Washington, D. C.

## MAGNESIUM

THERE will never be a shortage of magnesium. An inexhaustible supply of this metal is on hand. Its "ore" is ocean water. New manufacturing plants are now extracting from the sea far more of this strategic material than is obtained from all other sources in the United States. Thirty million pounds is the expected total production this year, and 90 million pounds next year, as against only seven million pounds in 1939 by the old methods. Introduction of the new method increased the figures at once to twelve million pounds (nearly double) in 1940.

Dr. R. H. Harrington, metallurgist in the General Electric Research Laboratory, in an address to the G-E Science Forum stated that "Even though the concentration of magnesium in sea water is quite low, there are about four and a half million tons of magnesium in a cubic mile of sea water. Thus only one cubic mile of sea water will furnish 90 million pounds of magnesium metal each year for 100 years!"

Three years ago Germany was the main producer of magnesium and was using it plentifully as an "Ersatz" or substitute. Now we are doing the same.

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## PIERCING FOG

THAT yellow light is no better at piercing fog than the light of an ordinary tungsten lamp is shown by experiments recently carried out by Dr. Matthew Luckiesh, research physicist and Franklin medalist, and L. L. Holladay, of the Lighting Research Laboratory of the General Electric Company, Nela Park, Cleveland, and reported in the *Journal of the Optical Society of America*.

The so-called fog-lamps, consisting of yellow lenses which absorb from 20 per cent. to 35 per cent. of the tungsten-filament light must contribute something to the seeing to offset the loss due to less light. No satisfactory tests have been published, but the present investigation makes it more than unlikely that they have any advantage. Similar fog-piercing claims have been made for the new sodium lamps. In this case there is no loss of light by colored filters, for the light is inherently yellow and practically monochromatic. Yet even this lamp showed no significant superiority over the tungsten lamp in fog-penetrating qualities.

The two lamps of equal intensity were tested side by

side in clear weather, moderate fog, dense fog, mist and snow. They were tested by day and by night. Also a pair of lamps of low intensity and a pair of high intensity were used. Many experienced observers made many readings on a Luckiesh-Moss visibility meter at a distance of 1,000 feet. No significant differences showed in the averages.

The report explains that the fog-penetrating power of a light does indeed depend on its color or wave-length, as has been generally known. Thus blue light, which is of short wave-length, penetrates fog less than red light, which is of long wave-length. The sodium lamp emits yellow light that is practically of a single wave-length. This wave-length is about midway between those of the red and blue lights. Hence the fog-penetrating power of the sodium light is just about middling.

The white light of the tungsten filament contains all the colors from red to blue. It is true that the blue rays are cut down by the fog, but the remaining red rays have a fog-penetrating power superior to the yellow light of the sodium lamps. This evens the score.

## SURVEY OF FOOD RESOURCES

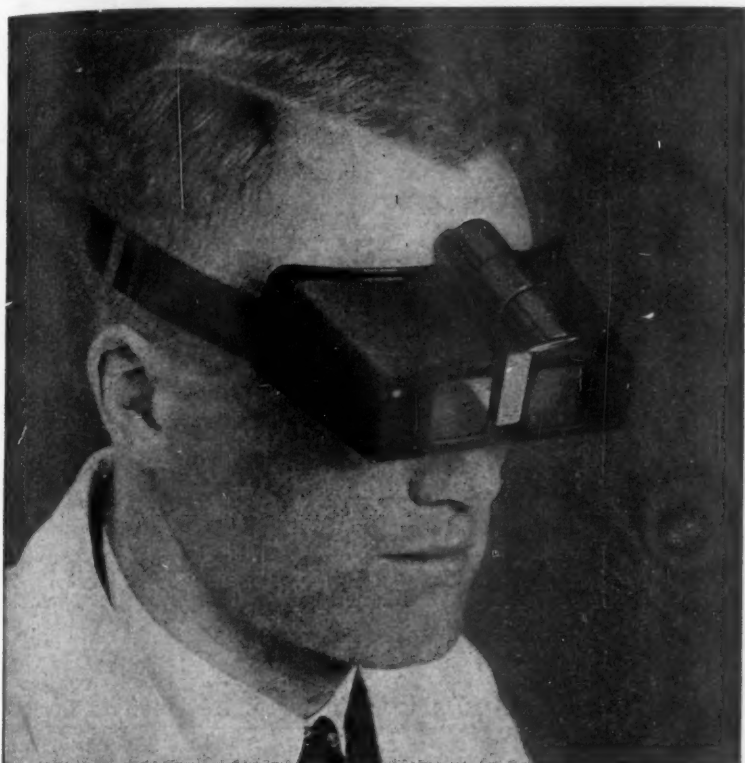
THREE FOURTHS of the world's 2,000,000,000 people depend so heavily on potatoes and cereal crops for food that their bodies are likely to suffer damage from the ill-balanced diet.

So it appears from an impressive survey of what the world is accustomed to eating in such comparatively good times as the years before 1939. Dr. Merrill K. Bennett, of the Food Research Institute, Stanford University, has reported the survey to the *Geographical Review*. He finds low income levels to blame for a great deal of the world's monotonous diet habits. And he declares that the only hope for improving human nutrition lies in a world-wide and economic peace, as well as a military and political peace, after the present war.

It is pointed out that "The United States, with 130 million people, is conspicuously the largest national group in the world to enjoy a diet composed of cereals and potatoes to as small an extent as thirty to forty per cent." All the other six countries that have national diets of this standard have together only about 85 million people. These are: Switzerland, Sweden and the United Kingdom in Europe; Canada, Australia and New Zealand.

Asia, excepting Japan, lives on eighty to ninety per cent. cereal and potato fare, in terms of calories. So does a great area of Africa, and also European Soviet Russia. The Americas and Australasia probably have no national groups accustomed to this degree of monotony. Japan is in the class of having a diet from seventy to eighty per cent. in the grain and potatoes class.

Southern Europe and most of South and Central America eat sixty to seventy per cent. cereals and potatoes;



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the rest of Europe ranges from forty to sixty per cent. A really liberal diet, according to one American nutritionist, would contain only twenty-one per cent. of this food.

To illustrate for Americans the monotony of such diet, Dr. Bennett shows that an American man who lived on eighty per cent. cereals and potatoes, and consumed 3,000 calories of energy value a day, would have just 600 of those calories in foods other than grain and potatoes.

One liberal serving of beef or chops would alone use up the 600. Or instead, he might add these to his day's ration of one pound of white potatoes and one and one quarter pounds of flour or meal: an apple, half an ounce of sugar, an ounce of bacon, half an ounce of vegetable oil, an ounce and a half of dried beans, half a pound of cabbage. These would add up to 600 calories.

Religious taboos and other psychological factors may keep some countries in a groove of eating an ill-balanced diet and suffering the consequences in malnourishment, but Dr. Bennett concludes that the chief reason for this condition in the world is poverty. Nations, like families, he says, presumably eat mainly cereal foods and potatoes because they can not afford variety.

#### ACCIDENTS IN INDUSTRY

THE cause of the repeated accidents of some workmen has been identified as the attitude of the accident victim himself by Dr. Alexandra Adler, of Boston Hospital and the Harvard Medical School.

That the accident-producing attitude is different in different workers and in different nationalities was shown by a study of a hundred industrial workers in Europe and a hundred applicants for workman's compensation in Massachusetts.

In America, over a fourth of the accident-prone workmen were over-fearful. That fear of accidents can produce them was demonstrated by a test on soldiers quoted by Dr. Adler in her report to the *American Journal of Psychiatry*. Half the soldiers on a cross-country ride were told that a ditch lay ahead of them. The other half were not informed. Three fourths of those who fell into the ditch were from among those who had been warned.

More than 23 per cent. of the American accident-prone workers had a fatalistic attitude that they were sure to be unlucky. Nearly 20 per cent. had a longing to be pampered and were happy while being nursed after an accident. Over 13 per cent. had a revengeful attitude toward parents or educators. In these, Dr. Adler considers that the repeated accidents are a sort of substitute for suicide.

These were the attitudes most frequently to blame for accident repetitions among the American workers. Among the European workmen, a revengeful attitude was responsible in 56 per cent. of the individuals. Alcoholism accounted for 12 per cent. (as compared with only 3.3 per cent. among Americans), the "unlucky" attitude for 10 per cent. and the longing to be pampered for 6 per cent.

Aside from the alcoholics, only eleven individuals could blame disease or mental deficiency for their repeated mishaps.

#### ITEMS

THE newly discovered Dutoit comet, first sighted from the southern hemisphere observatory of Harvard University at Bloemfontein, South Africa, has now been picked up by an astronomer in this country, Dr. George Van Biesbroeck, of the Yerkes Observatory. His data indicate that the comet is now in or near the constellation of Capricorn, which is almost due south and half-way from horizon to zenith at 9 P.M. Since it is now of the eleventh magnitude, there is no immediate likelihood of its becoming visible to the unaided eye. Sixth magnitude is about the lower limit of naked-eye visibility for astronomical objects. The Dutoit comet has also been reported by a Belgian astronomer, Dr. M. Delporte, of the Observatory at Uccle, near Brussels. Dr. Delporte's dispatch was relayed to Harvard through the international clearing house for astronomical information at Copenhagen, which continues to function despite the war.

A SHORTAGE in surgical and dental instruments threatens the country, according to the *Journal* of the American Medical Association. To avert it, the Office of Production Management has extended to the manufacturers of such goods "highest civilian preference rating" in connection with orders placed for materials for their manufacture. The rating includes also materials needed for the production of spectacle frames. The hospital apparatus and equipment and the surgical implements and supplies covered by the priority program include adhesive plasters, anesthesia apparatus and supplies, biologicals, antitoxins and serums, clinical thermometers, diagnostic instruments, hospital laboratory equipment and supplies, hospital operating room equipment, hypodermic syringes and needles, surgical and dental instruments, medicinal chemicals, rubber hospital sundries, hospital sterilizers, surgical dressings, x-ray equipment and medical and dental supplies.

A NEW generator, that kills bacteria and other microorganisms with very short sound waves, has been built at the University of California at Berkeley. The device, developed by Professor A. P. Krueger, consists of a nickel tube within a magnetic field, activated by electrical impulses. The tube is first elongated, then contracted by the alternate pulls of the magnets. So rapid is this oscillating motion that the nickel tube emits sound waves with a high frequency of 9,300 cycles a second. The tone is deadly to bacteria and viruses. Staphylococci, bacteria that cause boils and carbuncles, were subjected to this penetrating sound. The bacteria were all killed. Bacteriophage, a virus disease of bacteria, was also destroyed, and the cellular secretion from which bacteriophage is formed was made permanently inert. The generator was developed in the intensive study of bacteriophage carried on for the past fourteen years. Dr. E. J. Scribner, research associate, and B. B. Brown, technical assistant, aided Professor Krueger in his new sonic studies.

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## SCIENCE NEWS

*Science Service, Washington, D. C.*

## SOME PAPERS READ BEFORE THE ATLANTIC CITY MEETING OF THE AMERICAN CHEMICAL SOCIETY, SEPTEMBER 8 TO 12

DR. G. C. SUPPLEE, director of the biological and chemical laboratories of the Borden Company at Bainbridge, N. Y., stated that on the basis of vitamin studies in rats dietary lack of the "acid of life" vitamin, pantothenic acid, may be the cause of a new malady among British soldiers. Working with Dr. Supplee were Dr. R. C. Bander and Dr. O. J. Kahlenberg. The malady in the soldiers is characterized by fatigue, breathlessness, fainting spells and disturbance of the pulse rate. These symptoms could be due to failure of the adrenal glands to produce normal amounts of their life-essential hormone. The affliction can not positively be stated to have resulted from lack of pantothenic acid, Dr. Supplee said, but he and other investigators have found that rats deprived of pantothenic acid suffer hemorrhagic degeneration and wasting of the adrenal glands and die. Their death is usually unpredictable without previous sign of collapse, and after death destruction of adrenal gland tissue, marked kidney injury and acute hemorrhage of the heart are found. Pantothenic acid is a member of the vitamin B complex and is found in such foods as yeast, molasses, rice hulls and liver. It has been called the "acid of life" because it has been found in all animal tissues and is believed essential to all forms of life, although so far there is little or no direct evidence of human need for it.

THE electron microscope, a super-enlarging instrument that uses high-speed atomic particles instead of light waves, has many uses in industry, was reported by Dr. V. K. Zworykin and Dr. James Hillier, of the R. C. A. Manufacturing Company, Camden, N. J. Among the materials searched by its beams are steel surfaces, the structure of rubber, finely ground pigments and other things important in defense activities. Since the electron streams can penetrate only very thin slices of material, it is not possible to examine steel surfaces directly. Thin films of plastic, only a hundred-thousandth of an inch thick, are prepared, with surfaces that are replicas of the steel surfaces to be examined. These plastic "portraits" of the superficial structure of steel are then placed under the electron microscope and subjected to the atom-particle bombardments. The new instrument is also used in the study of living things too small to see with even the most powerful of light-using microscopes, such as the particles of disease viruses and bacteriophages, as well as to disclose details of structures of the tiniest bacteria, that are at the lower edge of light-wave visibility.

TIME is saved in great quantities by spectroanalysis, in which light given off by burning or glowing metals or other materials is split into its constituent colors by a prism or ruled grating, and the artificial rainbow thus produced is read for hidden chemical secrets. Dr. H. V. Churchill, of the Aluminum Company of America Aluminum Research Laboratories, described some of the advan-

tages of this quick analytical method. When a batch of aluminum alloy is being prepared for airplane construction, or a melt of steel for a battleship's armor, it is necessary to take small samples of the lot and analyze them quickly to make sure that the small but important additions of alloy metals are present in the right quantities. By the classic methods of test-tube analysis, these processes would take hours. By spectroanalytic methods, only minutes are required. New instruments have been introduced that carry on much of the work automatically, by substituting the photocell or "electric eye" for the human eye.

AMERICAN soldiers, with their high meat ration, are physically better equipped to meet certain types of war gas than are vegetarians, according to a report submitted by Dr. Jakob A. Stekol and Dr. William J. Conway, of Fordham University. Meat and some other protein foods contain two compounds known as cystine and methionine. These compounds, fed to rats, were found to detoxify benzene derivatives, used as war gases in 1914-18, and also employed in many industrial operations. The same compounds prevented ill effects from pyridine, a poison present in tobacco smoke, and from naphthalene, another industrial compound most familiar to the public in the form of mothballs.

THAT old age is a loss of elasticity, so far as arteries are concerned, was reported by Dr. J. Murray Steele, of the Welfare Island, N. Y., Hospital for Chronic Diseases. Dr. Steele measured the elastic coefficient of arteries in living animals and also measured directly the force-length and volume pressure relationships in arteries that had been cut from the body. The results have almost uniformly tended to show that arteries become less extensible with increase in age. Discovery of a chemical, elastin, which is found in tendons and which has elastic properties somewhat similar to body tissues may give an opportunity for finding the physicochemical changes that lessen elasticity in aging tissues. Dr. Henry S. Simms, of the School of Medicine of Columbia University, pointed out that the aging process which causes a progressively lowered resistance to nearly all diseases is responsible for ninety per cent. of deaths in the United States. The theory that senescence results from a random accumulation of injuries or degenerative changes is not supported by a thorough study of the problem. The urgent need of further research on the problems of old age and of funds to support the research was emphasized both by Dr. Simms and by Dr. Edward J. Stieglitz, of the U. S. National Institute of Health. In 1980, Dr. Stieglitz predicted, the total economic responsibility for the nation will fall upon less than half, 47 per cent., of the population, instead of the 55.7 per cent. that carried it in 1940. This assumes that the average man will be gainfully employed up to age fifty-five.

DR. THEODORE F. BRADLEY and Dr. David Richardson, of the American Cyanamid Company, stated that a technique something like soap-making, but more severe, is now being used to convert American-grown oils, like linseed and soybean, into drying oils for the paint and varnish industry. Quick-drying oils are urgently needed in both defense and civil industries, and because of the Japanese invasion the Chinese source has been grievously pinched, while the domestic production of tung oil along the Gulf Coast at present supplies less than 5 per cent. of our peace-time needs. The oils to be treated are first boiled with alkali and water at high temperatures. This converts them into a kind of soap, from which the fatty acids are then separated by adding mineral acid. These fatty acids can then be combined with glycerol to form the quick-drying oils.

A MILL made entirely of glass, for grinding pigments, inks, industrial finishes and other substances that might be contaminated by contact with the metal parts of mills of the usual type, was described before the paint and varnish chemists by Dr. D. B. Pall, of the Interchemical Corporation, a New York research firm. Essentially, the mill consists of a conical plug of ground glass fitting into a corresponding hollow ground-glass cone open at both ends. The set-up is very much like the ground-glass stopper in the neck of a bottle or glass stopcock. The material to be ground is fed in through a tube of synthetic rubber, by slight air pressure. The mill is driven by a small motor.

OXALIC acid, familiar as a household bleaching agent, is used in large quantities by several industries, including rayon, leather, textiles and at least one plastic. Its production from one of our most abundant and troublesome industrial wastes, sawdust, was discussed in several papers presented at the meeting. With proper chemical treatment, a hundred pounds of sawdust will yield nearly \$8 worth of important chemicals, according to Dr. Donald F. Othmer, of the Polytechnic Institute of Brooklyn. In addition to oxalic acid, appreciable amounts of acetic and formic acids can be produced, as well as wood alcohol. All these are at present needed in defense industries.

POISON sprays that need only to touch Japanese beetles to disable them were described by Dr. W. H. Tisdale and Dr. A. L. Flenner, of the du Pont pest control laboratory at Wilmington, Del. Contact with the beetles promptly paralyzes their mouthparts and forelegs. There are a number of compounds having this effect. All are derived from a complex organic chemical known as dithiocarbamic acid. Some of them have been found effective against other animal pests, among them the internal parasite causing the serious poultry disease, coccidiosis. The compounds prove their versatility by being deadly also to fungi that cause plant disease.

MUSHROOM raisers have a hard time in this motorized age, for lack of the material they have always used for the feeding of their sudden crops. Substitutes have been sought, especially by treating straw with various nitrog-

enous compounds. Better results have been obtained, according to B. B. Stoller, of Coatesville, Pa., by using wastes from the brewing and various food industries, which contain nitrogen in themselves, such as spent brewers' grains, malt sprouts, extracted cocoa shells, soybean meal and cottonseed meal. Potash and phosphates are added.

EVERY time you gulp down a gelatin capsule filled with quinine or some other medicine that would leave a nasty taste in your mouth, but for this protective covering, you add your bit to the world's indebtedness to an almost forgotten French pharmacist named Mothes, who invented the capsules in 1833. A sound motion picture summarizing the history of gelatin capsules, the work of David Hayden, S. H. Fox and R. P. Scherer, of the Gelatin Products Company, Detroit, was shown. M. Mothes made his capsules laboriously by hand; to-day a machine invented by Mr. Scherer turns them out in veritable streams.

SYNTHETIC rubber—or rather, synthetic rubbers, for there are a considerable number of different kinds—at long last begin to be produced on a quantity basis, was reported by Howard I. Cramer, of Sharples Chemicals, Inc., Philadelphia. Heretofore rubber-like synthetics have found it necessary to justify themselves on the basis of superiority to natural rubber in some critical property, such as resistance to heat, abrasion or solution in oil. Now, however, with the completion of new plants planned and under construction, "sufficient of the synthetic product should become available so that attention can be given to those tonnage applications involving simple replacement of the natural product."

HEAT causes sharply marked changes in the performance of one of the new elastic plastics, a water-clear substance called polystyrene. These changes were described before the meeting in a paper by T. S. Carswell, H. K. Nason and R. F. Hayes, of the Monsanto Chemical Company. Heated not quite to boiling point, to temperatures ranging near 180 degrees Fahrenheit, polystyrene changes from a hard, glass-like solid into a soft, ductile plastic. Heated further, up to boiling point (212 degrees) or a little beyond, it again changes, gradually, from the ductile to a rubbery state. The toughness of the material seems to increase with lowered temperatures, for it continued to rise as the polystyrene was progressively chilled to a temperature nearly 100 degrees below zero Fahrenheit.

PHOSPHORUS, important in defense industries and even more so in agriculture, is something we are not likely to run out of in the immediate future at least, it appears from figures set before the meeting by Dr. George R. Mansfield, of the U. S. Geological Survey. Phosphates, the compounds in which phosphorus occurs most abundantly in nature, are found in Florida, the Tennessee Valley and the Great Basin. Latest estimates place total available U. S. phosphates at more than 13,500,000,000 tons. This represents about 55 per cent. of the known supply of this essential mineral. Outside the United States, the greatest phosphate beds are found in the USSR and North Africa.



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## SCIENCE NEWS

*Science Service, Washington, D. C.*

## POISON GAS

Look out for poison gas in the war, Major-General William N. Porter, chief of the Chemical Warfare Service of the Army, warned in a dinner address delivered at Atlantic City before the American Chemical Society. General Porter pointed out that not treaties, but a careful balancing of possible advantages against disadvantages, is what has deterred the belligerents thus far from loosing gas.

He assured his audience that the United States has not been lagging in study and preparedness for chemical warfare, defensive as well as offensive. More than a thousand reserve officers, as well as the regular officers of the Chemical Warfare Service, are now on duty. In addition to a permanent advisory committee of twenty, more than a hundred members of the American Chemical Society have been appointed as consultants to the service.

General Porter stated that "We are well informed in the Military Intelligence Section of our Army of weapons, gases and instructions for their use by all belligerents, and have very considerable knowledge of the amounts and kinds of agents being manufactured to-day and stored in the arsenals of Europe, ready for use.

"Whether or not gas warfare will be used depends solely on whether Hitler's generals feel that the advantage to them would surely outweigh any disadvantages. Up till now they have not felt so, and I think rightly, since gas is primarily a defensive weapon and would have been of much more value to the retiring Russians than to the advancing Germans. Hitler understands well that mustard gas on British beaches would add materially to the precariousness of an invasion.

"On the other hand, should he believe that one gigantic overwhelming stroke with gas would win the war for him, I am convinced that he would use it without question. Treaties signed and sealed have not restrained dictators from any course of action suited to their purpose. This war will never be really 'all out' until gases once more flood the battlefields.

"Improvements in technique make possible gas attacks on a far wider scale than any seen in the World War. Fleets of airplanes equipped with chemical tanks make it possible to spray large areas with vesicant liquids not only on military personnel, but upon the civilian population as well."

## THE PRODUCTION OF CHLORINE

CHLORINE, a poisonous green gas needed in immense quantities in both defense and civil industries, is now available on an unlimited basis, through a new process reported at the Atlantic City meeting by its discoverers, Professor Arthur W. Hixson and Dr. Alvan H. Tenney, of Columbia University.

The best feature of the new process is that it does not require the use of any electric current, which is needed in the production process now most widely in vogue. Need for electricity in other vital defense activities, notably

aluminum manufacture, was in danger of creating a serious bottleneck in chlorine output.

The only raw materials needed are sulfur and common salt, both of which can be produced in this country by millions of tons. The sulfur is burned in air, producing dry sulfur trioxide. This gas is thoroughly infiltrated through salt. The material thus made, when heated, gives off chlorine gas, while the solid part remains behind as salt cake, or sodium sulfate, another chemical used in the manufacture of glass, rayon, paper and in many other industries.

The process is self-contained so far as energy requirement is concerned, for the heat produced by the burning sulfur is more than enough for the second step, where the chlorine is separated from the salt cake.

Uses of chlorine in industry are legion, and demand from defense-speeded plants is going up by leaps, according to Professor Hixson. He said:

"In 1940, when chlorine production was close to capacity, 605,000 tons were consumed in the United States, an increase of 120,000 tons over 1939. This year the demand is twice as great, and by 1942 it probably will double again.

"New uses for chlorine are found almost daily. Neoprene, principal ingredient of synthetic rubber, contains chlorine. Ethylene glycol, used to cool the latest high-speed airplanes, requires the chemical for its manufacture, as does ammonium picrate, the Navy's main source of explosives. Chlorine is also used to make the lucite windows of modern long-range bombers, and in the salt-water-proof plastic insulations of anti-magnetic cables which have recently been designed to combat the menace of magnetic mines.

"Huge amounts of chlorine may be needed at any time to purify emergency supplies of water for armies in the field, as it now purifies the nation's water supplies. Chlorine compounds have uses varying from cleaning women's dresses to scouring the sides of battleships before painting; from manufacturing health-restoring medicinals to preparing the latest types of war gases."

## SYNTHETIC RUBBER SUITABLE FOR TIRES

AMERICA'S automobiles would not necessarily be compelled to run on the rims or stay in their home garages if the overseas supplies of natural rubber were to be cut off. At least two of the several kinds of synthetic rubber developed in this country are suitable for tires, was reported to the society by E. R. Bridgwater, manager of the rubber chemicals division of E. I. du Pont de Nemours and Company.

The search for synthetic rubber was undertaken in the first instance in an effort to produce something suitable for tires, but qualities like high resistance to heat, abrasion and oil sidetracked practically the whole product into such uses as conveyor belts, gaskets and gasoline hose. Higher cost, too, has been a factor in preventing effective competition of the synthetics with the natural material.



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Wartime or other emergency would of course practically eliminate cost considerations. The decisive factor then would be the physical possibility of providing sufficient plant capacity, skilled labor, raw materials and power to go into quantity production of synthetic rubber. Mr. Bridgwater estimated that an investment of half a billion dollars might provide for the synthetic production of 50 per cent. of the rubber needs of the country.

Current synthetic production of general purpose rubber will be equivalent to only about 1.5 per cent. of our crude rubber consumption for this year. With new plants coming into commission, production next year should be raised to at least 5,800 long tons per month, about 10 per cent. of normal requirements. Developments now under way may improve that figure.

### THE STAR TWENTY-SIX DRACONIS

EVIDENCE that nature repeats itself, and that the laws of universal gravitation apply everywhere, was presented to the American Astronomical Society meeting at the Yerkes Observatory. Dr. Peter van de Kamp, director of Sproul Observatory, Swarthmore, Pa., and Dr. Dorrit Hoffleit, on leave from Harvard Observatory, reported preliminary studies of the distance and motions of the star known as number 26 in the constellation Draco, the Dragon.

These astronomers have determined that this stellar system is remarkably similar to that of Alpha Centauri, the nearest star, which is really composed of three stars, two of them comparatively close together, and each about as large and bright as the sun, and the other, called Proxima Centauri, 10,000 times as far away from the first pair as the earth is from the sun. In the case of 26 Draconis, however, the third star is about 25,000 times as far from the first pair as the earth is from the sun, making it the most distant companion of this type known. Dr. van de Kamp was careful to state that many uncertainties in the measurements existed, and that these results are only of a provisional nature, but that they show that the star 26 Draconis deserves special attention on the part of other astronomers.

Twenty-six Draconis has long been known as a close double star, of which each component is very similar in mass to the sun. The distant faint body, of the tenth magnitude, was discovered to be connected with 26 Draconis by Dr. Adriaan van Maanen, of the Mount Wilson Observatory, and C. H. Gingrich, of the Goodsell Observatory, in 1921, even though it is 738 seconds of arc (12 minutes of arc, or one fifth of a degree) distant.

Thirty-five plates taken at Sproul Observatory since 1913 were measured and reduced. The magnitude of the bright binary was cut down by means of a rotating sector, to approximate equality with the faint companion. The distance of 26 Draconis from the earth was found to be about 30 light years, whereas that of Alpha Centauri and its companion Proxima Centauri is  $4\frac{1}{2}$  light years.

Proxima Centauri is estimated to take about a million years to revolve around its primary stars; the tremendous distance of the companion of 26 Draconis indicates that a few million years elapse while it completes a circuit around the two central stars. This is the longest period

indicated for any gravitational system known. The period of the close pair is about eighty years, the same as for Alpha Centauri.

### NEBULAE

EVIDENCE that all the millions of nebulae observed in the far-flung regions of space are composed of stars was presented before the meeting of the society. Dr. Lyman Spitzer, Jr., of Yale University, stated that failure to resolve the so-called elliptical nebulae into stars had led to the suggestion that they are composed of dust and not of stars at all. However, his recent investigation rules out this possibility and makes it fairly certain that the ellipticals, like their better-known relatives, the spirals, are composed almost entirely of stars.

Nebulae are diffuse patches of light seen in the sky. Some of these are clouds of gas and dust situated within our own Milky Way galaxy, whereas others are at tremendous distances (the nearest is 680,000 light-years away) and are considered to be other systems similar to the Milky Way as a whole.

These exterior galaxies are mostly classified into two main groups—the ellipticals and the spirals. The former range in shape from globular to elliptical, and appear highly concentrated, showing no resolution into stars. On the other hand, the spirals appear as flattened disks, and have often been called the "pinwheels of space." Many spirals have been resolved into stars, but the ellipticals, whether globular or flattened, can not be separated into stars with our present telescopes.

"An evaluation of the rate of energy dissipation for atoms and for dust shows that interstellar particles of low density require only 40 million years at most to lose any great initial energy, and to come to equilibrium, with velocities less than 12 miles a second," Dr. Spitzer said. "Any interstellar matter in a globular galaxy must be almost entirely concentrated to the center or, in the case of elliptical systems, to the equatorial plane. The total mass of such matter in a globular system can not exceed  $1/500$  of its total mass, although no such limit exists for elliptical systems. In any case, the amount of dust or atoms throughout most of an elliptical or globular galaxy must be quite negligible, and the visible light from a galaxy of this sort must be largely direct starlight, not diffuse or scattered light."

Many photographs of exterior galaxies seen edgewise show the presence of dark matter in their equatorial planes. This is possible, according to Dr. Spitzer's theoretical investigations. The stars in such systems form an extended envelope around the assumed highly flattened disk of dark, dense matter.

### "SHOOTING STARS"

"SHOOTING STARS" that flash in the night and burst in the air do not explode like an artillery shell, but instead seem to fly apart due to atmospheric pressure when they plunge toward earth.

Dr. Fred L. Whipple, of Harvard Observatory, described his studies of the trails of 28 meteors which broke apart or burst in the air while shining brightly enough to be photographed. These trails are included in the

Harvard collection of over a thousand meteor trails taken during the last few years.

Although an internal explosion due to external heating and expansion may break the original meteoroid as it passes into the atmosphere, Dr. Whipple believes that the evidence of these trails shows that atmospheric pressure on the irregular surfaces of the broken fragments produces the observed changes in their direction. However, the process of splitting should result in deformations that would soon be smoothed by melting and vaporization by friction with the air.

There are photographs of two trails in which three successive divisions occurred as the meteor broke into more and more pieces, and one in which a double or multiple division can be detected. In another case the brighter component and the fainter one deviate together in the same direction, and the brighter (presumably the heavier) deviates more than the fainter. This would be explained on the basis of atmospheric pressure acting for a fraction of a second on irregular surfaces of the fragments.

Dr. Whipple said that "one meteor divided at a height of 48 miles, and two others at about 35 miles each. The splitting usually occurs at maximum light, or about two thirds of the distance along the meteor trail. Both slow and fast meteors are represented by the split trails, and at least three are members of meteor showers. Split trails do not appear unusual and do not seem to represent a distinct class of meteors."

### GROWTH HORMONES

A GROWTH-PROMOTING hormone, more powerful than any of the synthetic chemicals now in use for speeding root formation, inducing growth of seedless fruits and other recently discovered "plant magics," has been found in pollen by Dr. John W. Mitchell and Miss Muriel Whitehead, of the U. S. Department of Agriculture.

They obtained their material by extracting ripening corn pollen in ether and then evaporating the ether. A fatty substance is left, which is mixed with lanolin in a ratio of one to ten. This paste or ointment is then spread on the plant part where growth-stimulating effects are desired. A ring of it around the stem of a seedling bean plant caused an elongation between 1.5 and 2.5 times greater than that obtained by treatment of comparison plants with any of the synthetic growth regulators.

It is not unlikely that the pure substance itself, when it has finally been isolated, will have even more powerful effects, for the crude ether extract of pollen is very likely a mixture of several substances, not all of which have growth-stimulating properties.

Chemical analyses of the ether extract will be actively pushed, for if the active principle can be isolated and its chemical structure determined, it may be possible to make it artificially, at much lower cost than by extracting it from pollen.

The effectiveness of the newly discovered substance in making plant stems grow longer may be put to practical use by florists in getting longer-stemmed flowers or in producing longer-fibered stems in such textile plants as flax, hemp and ramie. Such large-scale uses will depend, of course, on working out large supplies of the chemical at low cost.

Another use that has been discovered recently for growth hormones has been in producing seedless fruits from unpollinated flowers. A large range of plants, from holly berries to tomatoes, has been thus treated with good results. Spraying orchard trees with the hormones has had the effect of restraining flower buds from opening until danger from late frost is past, of inducing apple and other trees to hang on to their fruit instead of dropping much of it prematurely and of hastening the ripening of oranges.

To obtain a supply of pollen for their researches, Dr. Mitchell and Miss Whitehead exploit bees bringing the yellow dust back to the hive. The bees are compelled to pass through a narrow, screen-lined pollen trap, which scrapes off their loads of pollen and lets them drop into a collecting box.

### ITEMS

WARNING against any repetition of the "hate" resolutions that marred the record of the American Chemical Society during World War I was sounded by Professor Harrison Hale, of the University of Arkansas, at the Atlantic City meeting of the society. Professor Hale called attention to the action of the society in 1918, in withdrawing honorary membership from three noted German chemists, Nernst, Ostwald and Fischer. "The inevitable effort to make amends for this inconsistent error of hasty action came in 1927, when Nernst and Ostwald were restored. Fischer died in 1919, but not before he is said to have refused to consider restoration. This bit of history is given so that as American chemists we may reaffirm our faith in the internationality of science and seek to protect this belief from any emotional attack that may come either from ourselves or from others."

PROPERLY cared for grazing land not only keeps cows contented; it supports larger populations of small birds, according to Gale Monson, of Albuquerque, New Mexico. To study the relation of overgrazing to reduction in bird numbers, four 160-acre plots were selected. Two of them were within an area formerly overgrazed, but now recovering its range value under the scientific management of the Soil Conservation Service. The other two were in a nearby area still subject to severe overgrazing. Careful censuses of the bird populations of all four areas were made. It was found that the two overgrazed plots were home to 92 birds representing 12 small-bird species, while the scientifically managed, better covered plots yielded a count of 186, with 14 species represented.

TAKING a cue from the Army, civilians in the United States may soon be buying their groceries in increasing quantity in the form of food powders. Since a pound of potatoes in powdered form equals ten pounds of spuds in the round, the saving which can be effected in transportation space is very large. Dehydrated foods developed in the Quartermaster Corps' research laboratory in Chicago are pronounced far more satisfactory in flavor and food value when they are cooked than dehydrated beans, peas and onions that were shipped over-seas to the American Expeditionary Force in the World War.



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## SCIENCE NEWS

Science Service, Washington, D. C.

## RADIOACTIVE PHOSPHORUS

A PRODUCT of the atom-smashing cyclotron, radioactive phosphorus, is announced as a treatment for a serious blood disease by Dr. John Lawrence, who is director of biological and medical research of the Radiation Laboratory at the University of California.

Polycythemia, a deadly disease of the hemoglobin-producing bone marrow, causes an abnormal multiplication of red corpuscles in the blood and is usually treated by drugs, bleeding, radium and x-rays. This new form of treatment, although not generally used, seems to offer advantages over the older methods.

Elements made radioactive in the cyclotron emit rays similar to those of natural radium or x-rays, but as they travel in the system as natural phosphorus, these charged phosphorus atoms are carried directly to the bone-marrow where red corpuscles are normally produced. Harmless to normal body tissues in the small amounts needed, the charged phosphorus atoms enter and destroy the abnormal cells. If orange juice is taken at the same time it speeds phosphorus absorption and aids retention so that even smaller doses are needed.

So effective were the phosphorus radiations in their action on the wide-spread abnormal red blood cells that the blood count of patients was reduced from 7,000,000 to the normal 4,500,000. One reason for the destructive action of radiophosphorus in abnormal cells while normal cells are unharmed is the fact that polycythemia-multiplied cells are new cells, and radioactive research shows that all new cells, normal or abnormal, use large supplies of phosphorus in their growth. When the phosphorus taken up by these rapidly multiplying cells is radioactive, they are destroyed by the atomic "explosions" that are continuous in the substance. Radioactive elements produced in the cyclotron are being used in the treatment of several other types of abnormal growth.

Dr. L. A. Erf, research associate now in the United States Army Medical Corps, assisted Dr. Lawrence in the polycythemia research.

## CONSTRICTED HEARTS

A HEART operation that is returning bed-ridden invalids to normal, active lives is being successfully used by thoracic surgeons in the University of California Medical School.

Sometimes rheumatic or tuberculous infections will invade the pericardium, the membranous, fluid-filled sac surrounding the heart. Normally this sac is flaccid and roomy enough to permit easy expansion and contraction of heart muscles in their blood-circulating action.

When the pericardium becomes infected, a condition known as constrictor cordis or Pick's disease results. Calcium, the hardening substance of bones, begins to coat the membranous sac, and it soon takes on a marblelike appearance as it hardens and shrinks. The heart is so restricted in its pumping action that only about half the

normal amount of blood can be handled. Besides extreme debility, the abdomen swells and the breath becomes short and difficult.

Surgeons, knowing that the pericardium is not essential to the heart's functioning, removed a large part of the bony sac; sometimes as much as three quarters of the calcium carbonate-hardened membrane, a most delicate operation, but performed successfully on four extreme cases. Even before the operation was completed the freed heart began to return to normal functioning, and the painful symptoms soon were relieved. The patients live comfortably without a pericardium and their hearts are able to pump a normal supply of blood throughout the body again.

The surgeons who conducted the operations on this rare disease, all members of the thoracic surgery staff of the California Medical School, are Dr. Harold Brunn, clinical professor of surgery; Dr. Alfred Goldman, instructor in surgery; Dr. Brodie Stevens, assistant clinical professor of surgery, and A. L. Brown, clinical instructor in surgery.

## NICOTIANA RUSTICA

VITAMIN for the enrichment of bread and poison for insect pests may be the double yield of one species of tobacco, so rank that even the hardiest veterans can not smoke it. Tobacco growers whose export market has been upset by the war are experimenting with its cultivation is announced by the U. S. Department of Agriculture, and at the new Eastern Regional Research Laboratory in Philadelphia chemists are trying out methods for extracting the two valuable compounds.

The tobacco species in question is *Nicotiana rustica*, a half-wild cousin of *N. tabacum*, or regular smoking tobacco. It has high content in both nicotinic acid, which is the pellagra-preventing vitamin, and nicotine, the poison used in great quantities in insect sprays.

Because of the resemblance between the two names, confusion often arises, leading some to believe that nicotinic acid has some of the poisonous properties of nicotine. This is not the case at all. Nicotinic acid was so named because it was first studied in *Nicotiana*, the tobacco plant, but it has since been found in a great variety of plants, including yeast. It is perhaps a pity that it was not found first in yeast; then it would have been called zymic acid and nobody would have been bothered.

If the effort to increase the country's supply of nicotinic acid from rustic tobacco proves successful, it will go far toward relieving one of the most troublesome of present chemical bottlenecks. Estimates are that 200,000 pounds of nicotinic acid will be needed this year for the enrichment of flour, and perhaps 20,000 pounds more for the direct treatment of pellagra. This demand is about twenty times as great as the total quantity of nicotinic acid manufactured in 1940.

Nicotinic acid is made synthetically from coal tar. However, the chemicals needed for its production in this

way are expensive, and they are becoming increasingly difficult to get at all. Nicotinic acid from the plant source is more costly to start with, but it requires for its processing only nitric acid, which is cheap and abundant.

### SMALL MINERAL CRYSTALS

MINERAL crystals so small that 1,000 of them laid end to end would reach only one inch have been successfully measured by Samuel G. Gordon, mineralogist of the Academy of Natural Sciences of Philadelphia.

These crystals are of a new mineral, discovered in a mine in Argentina, and flown air mail to the academy for description and naming. They are the smallest mineral crystals ever measured.

Called sarmientite by Mr. Gordon and Dr. Victorio Angelelli, of the Argentina department of mines and geology, coauthor of the paper in which it is described, the new mineral is found in fair-sized nodules of great purity, of a pale yellow-orange color, in iron sulfate deposits of the Santa Elena mine.

This mine, high in the mountains of the department of Barreal, lies between San Juan and Calingasta, at an elevation of around 5,000 feet. It has been worked only a short time, yielding alums for use in water purification. Already a number of rare minerals have been found there, some so rare that they had previously been found only at the original localities, mostly in Europe. Practically nothing was known about them until they were rediscovered in the Argentine mine, and restudied by Mr. Gordon.

The new mineral was picked out of a mass of rare minerals. The pale yellow-orange nodules were unlike anything seen before in the mine and excited the interest of Dr. Angelelli, who believed they might be a new mineral. A sample was dispatched at once to the academy, because of its high rank in the field of micro-mineralogy.

Mr. Gordon studied the nodules under a high-power microscope, and could see that they were made up of exceedingly minute prisms, the largest of which were only a thousandth of an inch long. One of the largest, for the smallest were only a twelfth as large, he mounted on the point of a pin, carefully orienting it under the microscope. It was transferred to a two-circle goniometer, a complicated instrument for determining the angles of minute crystals. Light signals could be seen as the various faces of the crystal were turned and the angles of the faces were measured. He was then able to draw a figure of the crystal and classify it as of the monoclinic system. Chemical analysis disclosed that it was a hydrous iron arsenate-sulfate.

The new mineral was named for Domingo Faustino Sarmiento, the Argentinian educator and statesman, who was born in 1811 and died in 1888. Sarmiento held the office of minister of public instruction and minister of the interior, and was made minister to the United States. While in his diplomatic post in Washington, he was made president of the Argentine Republic, in 1868. It was through him that American ideals in education were brought to the Argentine. He also founded the Cordoba Academy of Science in Argentina.

### MANGANESE

MANGANESE sufficient for all our needs can be produced right here in the United States as the result of a new process for the treatment of low-grade ores developed by the U. S. Bureau of Mines.

Manganese is of vital importance as an essential alloy in high-grade steels used both in defense and non-defense industries. Until now it has been possible to obtain the metal only from high-grade ores containing 48 per cent. or more of manganese. Of this the United States produced only about 3 per cent. of its needs, the rest coming from abroad. Last year Russia supplied about a fourth of the amount imported.

While high-grade manganese ores are scarce in the United States, there are huge quantities of low-grade ores. But these were useless because no practicable method of extracting the metal had been found. Success has now been achieved by the use of a new reagent developed as a result of researches in the laboratories of the Bureau of Mines, and known as DLT-958. This reagent floats a good part of the worthless materials away from the ore, leaving a concentrate from which the metal can be extracted by the usual processes. The bureau has also developed other reagents of a similar character so that the operation of a plant is not restricted to a single reagent.

The bureau has built, under a defense appropriation, a group of pilot plants at Boulder City, Nevada, of which the first unit has begun operations. The first test of the new reagent was made in this mill on ore containing 18 per cent. of manganese. It left a concentrate containing 53 per cent. of manganese. It is estimated that there are nearly a million tons of ore containing 10 per cent. or more of manganese in the Las Vegas area. Tests are continuing on ores from many widely separated localities.

### ITEMS

RECENTLY installed instruments of the U. S. Coast and Geodetic Survey geomagnetic laboratory at Cheltenham, Md., were able to make a complete record of the great magnetic storm that interrupted wire and radio communication before and during the magnificent auroral display of September 18. They were able to do this, Captain N. H. Heck, of the survey, explained, because they are insensitive, so that their indicators did not swing completely off the scale, as would have been the case with older, more sensitive instruments. Ranges in magnetic intensity of 2,540 gammas (geomagnetic units) in the horizontal direction, and of 1,390 gammas vertically, were recorded. The ordinary magnetic storm records a range of only 300 or 400 gammas.

IN preparation for the eclipse of the sun on September 21, according to Tass, Soviet observatories designed a number of new instruments to be used in photographing the sun's atmosphere during the eclipse. Among the most interesting of these instruments are the nebular spectrographs constructed in the Moscow and Leningrad Astronomical Institutes, which made it possible to study the spectrum of the sun's corona at an enormous distance from the solar edge, where it has never been studied before owing to its dimness.

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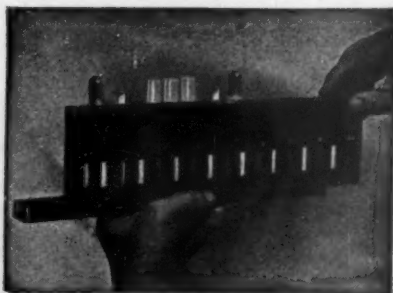
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## SCIENCE NEWS

*Science Service, Washington, D. C.*

## SOME PAPERS PRESENTED AT THE MEETING OF THE AMERICAN ASSOCIATION AT THE FIFTIETH ANNIVERSARY CELEBRATION OF THE UNIVERSITY OF CHICAGO

DR. R. A. MILLIKAN proposed the hypothesis that cosmic rays are created by the suicide of atoms in the loneliness of interstellar space, in the same manner that light is created by the partial self-destruction of atoms in the densely packed interiors of the stars. This hypothesis rests on discoveries made in five recent research projects by his fellow-workers in the Norman Bridge Laboratory of Physics. In sum, these researches indicate that atoms of five elements are far more abundant in interstellar space than those of any other element, and that such atoms are capable of transmutations, giving rise to high-speed particles like those that constitute cosmic rays. The broad surface of the earth itself is the spectroscopic screen on which should be spread the distinctive bands of cosmic rays, each characteristic of the element from which it originated. If they actually are found distributed in accordance with Dr. Millikan's prediction, this will constitute substantial evidence in favor of its validity. They are predicted as being thus distributed because the magnetic field of the earth should bend each band aside in proportion to the energy or speed of the incoming rays. The five elements for which the five identifying bands are sought are helium, carbon, nitrogen, oxygen and silicon. At least partial evidence has already been discovered that some of the bands exist. The discovery or non-discovery of the remaining ones will be critical for his hypothesis.

THAT atomic bullets as powerful as some of the cosmic rays and the most energetic man has ever produced—96,000,000 electron volts—have been manufactured with the University of California 225-ton cyclotron was reported by Dr. Ernest O. Lawrence. This is six times the highest energy previously achieved, that of deuterons (heavy hydrogen) at the same maximum speed. With carbon bullets Dr. Lawrence expects to be able to take six steps up the atomic ladder in transmuting elements. If iron were bombarded it would become arsenic. With the giant new cyclotron now building at Berkeley, carbon bullets of 600,000,000 electron volts will be possible. The research accelerating carbon atoms from carbon dioxide gas was done by Dr. Emilio Serge and Cornelius Tobias in the University of California Radiation Laboratory.

COSMIC rays are protons, "hard," high-speed atomic particles, when they arrive at the outer boundary of the earth's atmosphere, is indicated by experiments reported by Dr. William P. Jesse, Dr. Marcel Schein and Dr. Ernest O. Wollan, of the University of Chicago. On striking the atmospheric atoms, they give rise to the "middle-weight" particles known as mesotrons. Evidence supporting this conclusion was obtained by sending recording instruments aloft attached to free balloons that reached heights as great as fourteen miles.

NINETY-NINE per cent. of the weight of the earth is made up of only nine of the 88 known elements, was stated by Professor Henry Norris Russell, of Princeton University. All the rest have only one per cent. to divide among them. The same group of elements also make up the bulk of the other objects in the visible universe: stars, nebulae, comets and the meteorites that bring to us the only samples of the cosmos that we can actually get our hands on. Proportions are different, however: hydrogen, for example, makes up only half of one per cent. of the accessible earth-parts, whereas it constitutes the bulk of some of the stars.

WAR against epidemics of influenza or similar diseases that are particularly menacing in barracks, draftee camps, schools and other public buildings may be waged by spraying the air with shrapnel-like photons or particles of ultra-violet light. Possibilities of this method of controlling air-borne epidemics in wartime were described by Dr. Harvey C. Rentschler, director of research for the Westinghouse Lamp Division. Lamps for setting up a barrage of ultra-violet particles in the air and delicate measuring cells for predicting in advance the exact amount of ultra-violet radiation and the time needed to exterminate nearly all the germs in a given volume of air have now been developed. "Irradiated in an air-conditioning system, particles or photons of ultra-violet resemble somewhat the shrapnel sprayed at a fleet of raiding bombers," according to Dr. Rentschler. "Some of the ultra-violet photons make direct hits which disintegrate thousands of bacteria. Other photons miss their mark and still others score partial hits which cripple germs and render them ineffective. The result is air cleansed of 90 per cent. or more of its bacteria count."

DROPPING without a parachute through two or three miles of thin air will not cause a man to lose consciousness unless he is scared. On the contrary, the experienced jumper thinks faster and more clearly. His sight seems to be improved but his hearing is poorer. He breathes more rapidly but his heart action is little affected. These, in summary, are the physiological effects of long drops, as reported by Professor Andrew C. Ivy, of Northwestern University. Data were gathered during five high-altitude delayed-opening jumps by A. H. Starnes. Mr. Starnes was described by Professor A. J. Carlson, of the University of Chicago, one of the group of scientists conducting the research, as "one of the coolest-headed, most courageous men I have ever met." He keeps his wits about him even when tumbling and spinning through space in the most hazardous positions. He has made some 300 jumps from all altitudes up to 10,000 feet. In his jumps, Mr. Starnes carries a motion picture camera to record

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type and rate of spin, a barograph to record atmospheric pressure changes, a broadcasting transmitter, an altimeter, an automatic stop watch, and special oxygen mask and helmet. With his aviator's suit, all this apparatus increases his own body weight of 190 pounds to a jumping weight of about 300 pounds.

DR. CLAUDE E. ZOBELL, of the Scripps Institution of Oceanography, stated that bacteria and other minute forms of life, of types definitely belonging to the land, are found in the upper air far out over the oceans. Besides the land microorganisms, there are many bacteria that are known only from salt water. The sea bacteria get into the air encased in droplets of water cast up by the sea in a number of ways. These droplets are not much larger than bacteria themselves; their average diameter is about one micron, or  $1/25,000$  of an inch. Dr. ZoBell explained that "a particle the size of a bacterium would be carried nearly 3,000 miles by a steady wind having a velocity of ten miles per hour before it would fall to earth from a height of 100 feet, and it would be carried farther aloft by an updraft of 0.7 miles per hour. Thus any small particle which finds itself in the air may be suspended there almost indefinitely unless carried back to earth by larger droplets of precipitation. The horizontal distance over which microorganisms may be transported is almost limitless and is largely determined by their ability to survive the atmospheric environment. While undoubtedly many of the bacteria carried into the air are killed almost immediately by sunlight, desiccation, ozone or other adverse conditions, marine bacteria have been known to survive suspended in the atmosphere for several hours and the terrestrial bacteria found over the ocean hundreds of miles from land must have been in the air for several days or a few weeks." The number of pollen grains found in the air over the ocean depends on distance from land and direction and velocity of the wind. As compared with numbers over the land, pollen grains over the ocean are very scarce—from less than one to some 16 or 18 per cubic meter of air, as measured over the Atlantic between Sweden and New York. Pollen counts in air over land average 18,000 per cubic meter. Virtually no pollens are found in the purest marine air.

PARAMECIUM is a microscopic one-celled animal that swims in stagnant waters. Its aggregations, forming the most elementary kind of social groupings, are held together by chemical attraction. The chemical basis of this simple society was described by Dr. H. S. Jennings, of the University of California at Los Angeles. The water around an individual Paramecium becomes faintly acid. Another Paramecium, chancing into this acidified zone, becomes unable to leave it. Every time it approaches the boundary, it is impelled to turn back. Dr. Jennings found that he could reproduce this chemical social attraction simply by introducing a bubble of carbon dioxide into the water. It set up a charmed chemical boundary just like that of the Paramecium's natural secretion, which the little animals could enter but which they could not leave. While Paramecium normally reproduces simply by splitting into

two parts, it does at times form sexual unions. There are not merely two well-defined sexes in this animal group, but four sex types, capable of six different ways of pairing off. When masses of individuals of two different sex types are mingled, instead of simply pairing off, they rush together into a tight crowd, which sticks together "as if their bodies were covered with glue." None seems to be able to leave, although "often an individual visibly struggles as if trying to escape from the attachment to another individual, but in vain." Finally, they break up into smaller groups, and then into mating pairs. These exchange halves of chromosomes, then separate and swim their solitary ways, proceeding to multiply by division.

BUDS on the tips of plant branches literally poison their younger brothers to maintain their position of dominance. They secrete a growth-checking substance which prevents the development of lateral buds, or at most permits them only limited growth. According to Dr. John W. Mitchell, of the U. S. Department of Agriculture, it has long been known that plant stems continue their growth because the bud at the end has this dominance over other buds. It has also been known that if the terminal bud is removed, other buds farther down begin to develop, sometimes with a new establishment of dominance by one of the awakened lateral buds. But there has been no agreement among botanists regarding the mechanism underlying this phenomenon. Lately, however, it has been demonstrated that substances extracted from certain parts of plants inhibited growth when applied to the buds of a normal plant. Synthetic growth-regulating substances have also been prepared which have similar effects.

THAT evolutionary changes in plants can be promoted by treatment of actively growing tissues with sulfanilamide, which produces effects similar to those brought about by colchicine, was reported by Professor John M. Beal, of the University of Chicago. The germ-killing drug stops the process of mitosis or cell division in mid-career, causing the formation of extra large cells with double or quadruple the normal number of chromosomes. This in turn often brings about the origin of strange new plant varieties, some of them giants.

PROFESSOR CARLOS MONGE, of the University of San Marcos, Lima, Peru, stated that life at two to three miles above sea-level, where the system has to become used to getting along on little more than half rations of oxygen, has transformed the people of the Andean uplands into a distinct physiological variety of the human species. Lowlanders going into high country become acclimated after an initial period of "mountain sickness"; but the permanent dwellers at great altitudes are not merely acclimated, they are adapted, and have measurable differences in both physique and chemical constitution from the lowland peoples, the eminent Peruvian scientist stated. There are certain similarities between a height-acclimated lowlander and the permanent altitude dweller. In both, the blood is actually "thicker" than it is at sea-level: the fluid is more viscous and the corpuscles are both larger and more numerous.

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There are also notable chemical changes in the blood, especially in relation to oxygen and carbon dioxide exchange. However, the highlander's heart is larger in proportion to his body, his lungs have larger air capacity and their capillaries bring the blood more efficiently into contact with the air. Pulse rate is definitely slower, and even severe exertion fails to speed it up very much. This adaptation to living at great elevations has its reflection in the sociological behavior of the people. Every year, large numbers of Andean men, driven by necessity, migrate to the coastlands to work in the fields. But they never stay. They do not become acclimated to the "thick" air of the lowlands. The sociological effects of life at high altitudes show themselves also in population figures. Fertility drops sharply in people from the lowlands who migrate to the plateaus and stay there. This infertility at high altitude has been noted in animals as well as in human beings. Lowland stocks do not breed successfully on the heights. It is even difficult to hatch chicks from lowland eggs. The difficulty of raising enough meat animals was responsible for the transfer of the capital of Peru from its original site at Jauja, at 13,000 feet, to Lima at sea-level.

FURTHER evidence bearing on the mystery of submarine canyon origin was presented by Professor Reginald A. Daly, of Harvard University. He disagrees with those who hold that these gashes in the submerged edges of the continents, now known to be world-wide in their distribution, were cut by rivers during a period of recession in ocean level, and then re-flooded. He admits an ocean-level recession during the Pleistocene ice age, but claims that the canyons were cut under water nevertheless. His theory is that currents of water, heavy with mud, flowed under the clear water of the ocean, and that these did the cutting. The submarine currents flowed under the clean water because they were heavier, just as ordinary rivers flow through the land under a lighter atmospheric "ocean." The place of clouds was taken in the case of the submarine rivers by the lines of breakers, constantly piling fresh masses of water against eroding shores, to load themselves with silt and sand and flow down along the bottom, over the edge of the continental shelf. Rise of sea-level as the continental glaciers melted and refilled the ocean basins halted the process at the end of the ice age, and left the canyons drowned and hidden until their comparatively recent discovery.

TURNING coal into oil can be conducted more efficiently as a result of a discovery about relative transparency of thin coal slices, described by Dr. G. C. Sprunk, of the laboratory of the U. S. Bureau of Mines, Pittsburgh. Coal that is translucent when cut into thin slices by suitable apparatus can be converted into oil easily and economically. But when the coal slices are opaque, it is a sign that that particular product of the mine should be put to other uses than oil conversion.

GEOLOGISTS seeking oil have adopted and adapted a method first used by archeologists seeking ancient ruins, according to Dr. Edward W. Owen, petroleum geologist

of San Antonio, Texas. Some years ago, students of antiquity discovered that by flying high above terrain where ancient cities and fortifications once stood, they could often see traces of their outlines on the ground that could not be detected by observers at surface level. Similar methods are now beginning to be used by geologists, to trace the outlines of oil-bearing formations or other rock structure of economic importance or scientific interest. Information thus obtained is checked by other techniques already in use, such as the creation of artificial earthquakes with heavy charges of dynamite and the analysis of the waves which they send through the earth.

PROFESSOR WILLIAM S. COOPER, of the University of Minnesota, stated that the climate of America to-day is more like that of the Pleistocene ice age than was the period immediately after the glaciers had melted away. For several thousands of years after the ice age, the climate of North America was warm and dry. This conclusion was based on the examination of fossil pollen grains found in vast numbers in ancient buried bogs. They show the presence of mild-climate trees considerably north of their present limits of growth. Following the warm, dry period, the climate has become cooler and more moist during the past few thousand years.

SWALLOWING raw eggs, with the idea of getting some easily digestible protein, is all a mistake, according to Dr. Donald D. Van Slyke, of the Rockefeller Institute for Medical Research. If you really want to make egg-white digestible, he said, boil it hard, then rub it into fine particles through a sieve. Dr. Van Slyke's address had to do with the physiology of the amino acids, which are the units or building-blocks of which proteins are composed. There are twenty-one amino acids which the human body must have. Then it can manufacture itself out of other materials if they are not supplied from outside sources. The other eleven can not be synthesized within the body; they must come ready made, or we starve. Special effects of various amino acids have been studied on animals. Some of them have special actions, in neutralizing certain definite poisons.

VIRUSES of diseases like smallpox and yellow fever, that are followed by years-long or lifelong immunity to further attacks, are not cast out of the bodies of recovered patients. They remain with them as long as the immunity lasts. However, they are no longer to be dreaded, but become the servants of those who have bested them, steadily stimulating the production of substances that protect against new invasions. This theory of immunity following virus diseases was presented by Dr. Thomas M. Rivers, director of the hospital of the Rockefeller Institute, New York City. Other diseases caused by viruses leave the recovered patient immune for only a relatively short time. This is the case, for example, with influenza and the common cold. Following these maladies the body does rid itself of the virus. As a consequence, it has no continuing stimulus to produce immune substances, and when a new infection attacks there is no effective defense ready to repel the invader.

# INTERSCIENCE BOOKS

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By **HAROLD H. STRAIN**, Ph.D., *Carnegie Institution of Washington, Stanford University, Calif.*

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This book is important to research workers not only in the field of pure chemistry, but also in the allied fields of biochemistry, physiology, bacteriology, pharmacology, etc.

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C. N. Frey and W. R. Johnston in "News Edition" of *Am. Chem. Soc.*

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## SCIENCE NEWS

Science Service, Washington, D. C.

## THE ATMOSPHERES OF DISTANT STARS

DR. OTTO STRUVE, director of Yerkes Observatory, uses the terms "reversing layers," "chromosphere" and "corona," in describing the outer portions of stars which appear to have shells of gas surrounding them, although their atmospheres are probably not exactly the same as the sun's.

The picture of a star as a spherical mass of gas with an opaque surface radiating most of its light is no longer one which tells the whole story. During the past two years, Dr. P. Swings and Dr. Struve have secured a large number of peculiar stellar spectra at the new McDonald Observatory in Texas. These, and observations from Mount Wilson and Victoria, formed the basis for Dr. Struve's recent discussion before the American Astronomical Society.

There are two groups of extended atmospheres. The first kind remain at rest with respect to the star itself, while the second expand, with more or less rapid motion. Novae, or new stars, are characterized by expanding shells which are eventually observed visually as well as spectroscopically, and appear to form what are called "planetary" nebulae.

Dr. Struve advances the hypothesis that fundamentally all stars which exhibit shells are alike, and that the tendency of a star to produce a shell results either from rapid rotation of the reversing layer (portion of its atmosphere which produces the dark lines in the star's spectrum) or from a tendency of the star to become double. This latter case is observed in the star Beta Lyrae, which is shaped like an hour-glass, and has a tail of matter streaming from it and forming a shell around it.

In stars with shells, three layers are distinguished. The first is the stationary reversing layer, but it is in rapid rotation; then comes an inner stationary shell which shows little or no rotation, and which Dr. Struve calls the chromosphere; finally the outer, expanding shell, which he calls the corona. In some stars the outer shells are one or the other or both opaque, while in others they are transparent, and these differences produce important observed differences in their spectra. However, Dr. Struve pointed out that there are stars which are known to be in rapid axial rotation, but which show no shells around them. No explanation for this is given at present.

Closely related to Dr. Struve's researches are those of Dr. Paul W. Merrill, of Mount Wilson Observatory. He classifies the lines observed in a star's spectrum into three groups: "stellar" lines are produced in the reversing layers of the stars themselves; "semi-detached" lines come from extended stellar atmospheres or shells, and from the so-called planetary nebulae; "interstellar" lines originate in clouds of sodium, calcium and other elements in the tremendous spaces between the stars. The interstellar lines are recognized because they do not shift their positions according to the star's motion, as do stellar lines. The semi-detached lines show similar characteristics, but

do not increase in intensity with increasing distance of the stars.

## ARTHRITIC PAIN

THAT relief for the arthritic stiffness and soreness that plagues many men and women past forty years of age can be given by treatment directed toward a newly discovered cause of the condition, is reported by Dr. Charles S. Capp and Dr. Stacy R. Mettier, of the University of California Medical School.

Pain and muscular stiffness of neck and shoulder that make it impossible for the patient to comb his own hair, reach behind his back, or that even prevent the use of hands in fine movements such as sewing or writing, were formerly laid to two causes: an injury or pressure of a rib on the brachial plexus, a great nerve in the neck; or a cancerous or bacterial attack that destroys neck vertebrae. But it was found that many patients past their fortieth birthday suffered the symptoms when these causes were not present. Some physicians put the blame in such cases on an inflammation of a spinal nerve.

Dr. Capp and Dr. Mettier, using a new method of diagnosis, found that x-ray pictures of thirty patients showed bony growths which projected into the canals connecting the vertebrae in the spine. These bony obstructions usually occurred between the fifth and sixth and sixth and seventh cervical vertebrae, near the large bone projecting at the back of the neck, limiting the space allowed for passage of spinal cord and nerves. This resulted in the crippling pain to neck and arm and often affected chest muscles.

Heat applied over the affected neck vertebrae, with massage, traction and manipulation relieved the majority of patients of pain.

## MOTTLED ENAMEL OF TEETH

FLUORIDES, the cause of the disfiguring "mottled enamel" of teeth, can be removed from the drinking water by two simple methods designed for use in homes or small institutions having their own water supplies. The methods were devised and patented by Dr. Elias Elvove, chemist of the U. S. Public Health Service, who assigned his patent rights to the United States Government.

How many American children have the ugly, irremovable brown spots on their teeth, result of drinking water and eating food cooked in water containing fluorides during the tooth calcification ages, is not definitely known. The condition, also called "black tooth," according to one estimate, afflicts 5,000,000 people in 31 states.

Community water supplies can be freed of fluorides by a relatively cheap method now commercially available. The latest method for individual home or small institution use patented by Dr. Elvove is to shake up two gallons of water with half a pound of tricalcium phosphate, finely powdered, for half an hour; or for shorter periods totaling half an hour. The mixture is then allowed to settle

and is filtered through a suitable filter. Ordinary commercial tricalcium phosphate is suitable.

Magnesium oxide is used instead of the tricalcium phosphate in the earlier method devised by Dr. Elvove. This has the advantage, he points out, of also sterilizing the water and of being cheaper. The chief disadvantage is that it makes the water more alkaline, though this can be counteracted by adding a suitable amount of acid. It is suggested that for home use, vinegar might be used. Any one planning to remove the fluorides from his home water supply should seek the advice of the health department chemist in order to be sure of carrying out the procedure correctly.

### GESTURES AND RACIAL DESCENT

YOUR gestures with hand or head as you talk are not inherited from your dead ancestors. Gestures are picked up from people around you, and living in a different land you might be a different person, so far as gesture mannerisms go, is concluded by Dr. David Efron, of Sarah Lawrence College, in a study of New Yorkers, entitled "Gesture and Environment," published at Columbia University by the King's Crown Press.

Dr. Efron has analyzed gestures of two sample groups—southern Italians and eastern Jews in this city. Each group has distinct mannerisms which disappear as an individual becomes assimilated into American life. The more complete the assimilation, the fewer arm-sweeping Italian gestures or hand-waving Jewish gestures an individual will use. In fact, as Americanization advances, these types use fewer gestures. Like people with two languages, they may acquire hybrid gestures, part American and part foreign. They also take on Americanisms, which run to such mannerisms as emphatic fist movements and slicing.

To study these New Yorkers, Dr. Efron observed gestures in homes, restaurants, at race tracks, in summer resorts and schools. The claim by "the high priests of political anthropology in the Third Reich" that the amount and manner of gesticulating of an individual are determined by racial descent is not upheld by scientific analytic study. Stating that these authors have nothing to go on but vague impressions and a few "selected" photographs, Dr. Efron says emphatically: "Their theories of 'race' are plagued with conceptual fictions that have no place in scientific reasoning."

### ELECTROPLATING WITH IRON

PLATING a nobler metal with iron may seem like plating a gold watch with brass. Yet there are uses for just such a process. Although the commercial uses of iron plating are minor in character, they are sufficient in number and importance to justify further study of the subject, in the opinion of C. T. Thomas, technical aide of the U. S. Bureau of Engraving and Printing, expressed in a paper presented at the Chicago meeting of the Electrochemical Society.

The most active interest in iron plating centers around its use in electroforming molds for rubber, glass and plastics, as perfected in the laboratories of the United States Rubber Company. The iron is electro-deposited on

a pattern, thus forming a strong mold for the materials mentioned. Another recent use is the production of electrolytic iron powder for plastic metals—developed at the Mellon Institute—which can be molded and compressed into shape and then become a solid mass like any other plastic.

Iron is cheap and abundant and has strength. It can be plated on the back of a finer metal to give it strength. This process has been used for making the plates for printing government currency and bonds. A nickel face is first deposited electrically on the mold, taking all its delicate detail. This is then backed by a heavy deposit of electrolytic iron.

Electrically deposited iron is very pure, resists rust and has unusual magnetic properties. Iron plating has been used for more than a hundred years, but most of these uses are now obsolete.

### THE SUPPLY OF STEEL

A SHORTAGE of steel even for defense needs in 1941 and for the next few years is foreseen by Dr. Matthew A. Hunter, professor of metallurgy at Rensselaer Polytechnic Institute in Troy, speaking on the General Electric Science Forum.

Even our scrap iron bin is practically empty, he declared. For years we sent large quantities of our scrap iron to a belligerent eastern nation. Now we have reason to regret this action. This year the steel industry will produce about 90,000,000 tons of steel. But this is 8,000,000 tons short of our requirements. Next year the shortage will be 27,000,000 tons. By the construction of new plants, the steel industry expects to increase its capacity by 10,000,000 tons. But this still leaves a shortage of 17,000,000 tons which can only be made up by civilian conservation.

Already the Office of Production Management has indicated that a 50 per cent. cut in automobile manufacture in 1942 will be necessary in order to save some 4½ million tons for defense. Further restrictions will be necessary but can not entirely make up the deficiency. Dr. Hunter thinks, however, the situation is not altogether hopeless. He points out that some 14,000,000 tons of aluminum utensils have been contributed by American householders. He believes that every American household could contribute twenty pounds of scrap iron. They can do with fewer refrigerators, washing machines, ranges, and other articles containing iron. Also there are untapped sources of scrap iron. He pointed to the automobile graveyards that dot the country-side. Iron fences, grills and other useless structures can be removed.

### FURTHER PAPERS READ AT THE CELEBRATION OF THE UNIVERSITY OF CHICAGO

PROFESSOR EVARTS GRAHAM, of Washington University, St. Louis, stated that far too many patients with bronchial cancer are now denied the benefit of effective treatment and allowed to die "because no steps are taken even to arrive at a diagnosis until the condition is hopeless." Bronchial cancer constitutes about 10 per cent. of all cancers. Among patients coming to Barnes Hospital in

St. Louis, 88 per cent. were in such an advanced stage of the disease that they could not be operated on. Yet in 75 or 80 per cent. of cases a bronchoscopic examination and biopsy will establish the diagnosis even in early cases. The only treatment known to be effective for this condition is complete surgical removal of the cancer, which usually means complete removal of the lung.

STUDIES by x-ray of more than forty thousand persons indicated that the most reliable and desirable of the body's defenses against tuberculosis is calcification, or turning the infected region into bone, was reported by Dr. Robert G. Bloch, associate professor of medicine at the University of Chicago. Although it has been believed that calcification is merely a secondary process following complete healing of the disease, the development of bony matter from the infected area actually should be investigated as one of the most promising methods of cure. "The necrotic process, the forerunner of calcification in the adult, is the all-important epidemiologic problem in tuberculosis. Small as it may be, as a potential excavation which will discharge its infectious content, it remains the ever-dangerous redistributor of the infection to the same individual and to others. The possible fostering of the process of calcification, therefore, seems a worthy goal of investigation."

WHEN tuberculosis germs are present in the body, the blood makes chemical signals. The first readings of these were presented by Professor Florence B. Seibert, of the Henry Phipps Institute, Philadelphia. A recently developed, highly accurate method of electrical separation has shown that there are four proteins in blood serum. One of these is an albumin; the other three are globulins, designated respectively as alpha, beta and gamma globulins. In rabbits inoculated with tuberculosis bacteria, the albumin always decreases. It is always lower than the lowest figure for a normal animal. The globulins, on the other hand, show increases. The alpha form usually shows the first and most pronounced increases, but the gamma globulin also frequently becomes higher in animals in which the disease has not yet become very serious. But when beta globulin increases, death usually follows.

FATAL pneumonia often starts with a chill. This was explained by Professor Oswald H. Robertson, of the University of Chicago. Chilling of the body surface causes a slight contraction of the epiglottis, the lid-like valve that closes the upper end of the windpipe during swallowing. With this vital valve reduced to a poor fit, fluids from the nose, mouth and upper part of the throat can get down into the lungs, carrying with them accumulated pneumonia germs. If there is an irritated condition in the lungs, as from a cough already started, pneumonia is likely to follow.

#### ITEMS

THE comet whose discovery was recently reported by the Soviet astronomer Neujmin has been identified by L. E. Cunningham, of Harvard Observatory, as the Schwassmann-Wachmann I comet discovered by the two German astronomers in 1927. This comet was picked up last

month on two photographic plates at the Boyden Station of Harvard University at Bloemfontein in South Africa and reported at that time.

DISCOVERY of a new vitamin, the eighth in the large group of B vitamins, was announced by Dr. Roger J. Williams, of the University of Texas, at the vitamin symposium at the University of Chicago. The new vitamin is folic acid, taking its name from the Latin word for leaf because it is found in great abundance in leaves. Like the other B vitamins, folic acid is universally present in all animal tissues examined as well as leaves, Dr. Williams said.

IRAQ'S earliest known inhabitants, the Sumerians, were fond of pork. They also ate a good deal of mutton and beef, and smaller quantities of game and fish. These facts are brought out in a study of animal bones found in buried city ruins at Tell Asmar, a site near the Tigris River a few miles from Bagdad. The study was made for the Oriental Institute of the University of Chicago by Dr. Max Hilzheimer, the German zoologist. Groupings of the bones found in the ruins of houses, palaces and temples, indicated 14 or 16 pigs, 10 gazelles, 6 sheep or goats, 5 wild asses or onagers, 4 or 5 cattle, 3 deer and 2 dogs, besides a number of bones of unidentifiable species of birds and fish.

WHAT one university has done in the way of "pre-habilitating" its students, in advance of their possible call to military duty, is told by Dr. Ruth E. Boynton and Dr. Harold S. Diehl, of Minneapolis, in a recent issue of the *Journal of the American Medical Association*, published in Chicago. The University of Minnesota undertook to find out what proportion of its students of draft age were already fit for service, and what could be done for those who fell below standard. Naturally, in the undergraduate group there were many below draft age (nearly three fourths in the College of Arts and Sciences) whereas in the graduate school 92 per cent. were already registered. Of the entire group registered, one third were put in the "defective" classes 1-B and 4. One striking fact was the relatively low percentage of deferments for bad teeth, and the relatively high proportion of those with defective eyesight. This reverses the situation found in the general population. Seven per cent. of the group were rejected for general underdevelopment. These can be put into good condition by a proper program of diet, rest and exercise.

THE last paragraph under "Items," page 11, of *Science Supplement* of September 19 says "Since a pound of potatoes in powdered form equals ten pounds of spuds in the round, the saving which can be effected in transportation space is very large." Professor G. Bohstedt, professor of animal and dairy husbandry at the College of Agriculture of the University of Wisconsin, writes: "On page 970 of the 20th edition of 'Feeds and Feeding' by Morrison, the average of 471 analyses of potato tubers gives 21.2 per cent. as the dry matter content. Allowing 4 or 5 per cent. moisture content even in powdered potatoes, these could at most equal only 4.5 times spuds in the round."

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## OUTSTANDING BOOKS IN CHEMISTRY

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## SCIENCE NEWS

*Science Service, Washington, D. C.*

## BIOLOGICAL ENGINEERING

BIOLOGICAL ENGINEERING was the subject of a symposium heard during the one hundred and seventy-fifth anniversary celebration of Rutgers University. Applied biology may become a major profession in the coming years and the science of living things will produce results that may even outdistance the fruitful benefits of chemistry, physics and the older branches of engineering.

That the primary needs of man are for food, clothing and shelter was pointed out by Dr. Vannevar Bush, president of the Carnegie Institution of Washington and director of the Office of Scientific Research and Development. Into the first two of these the application of biological science enters very definitely, and it enters somewhat into the third. The ultimate field for the biological engineer is correspondingly wide, and his ultimate position in society will be correspondingly important. It is to be expected, in fact, that he will become more completely integrated into the operation of the social organization than the engineer who deals with secondary or subsidiary needs, such as transportation or communication. The direct applications of biological science to practical affairs become daily more numerous. It is the job of the biological engineer to understand and influence the process by which this is occurring, in order that it may occur more completely and more effectively, to the end that life on this planet may be more secure and less harassed by ills, with more of leisure and comfort, and less of poverty and distress.

The accelerating pace of discovery in the biological sciences through the impact of molecular chemistry was cited by Dr. Hugh Stott Taylor, of Princeton. "We need only call to mind," Dr. Taylor said, "the synthetic vitamins with structures elucidated, and activities ever better defined, the hormones of sex and of the pituitary gland, the new agents of chemotherapy, sulfanilamide and its successors, the carcinogenic agents so closely related chemically to the sterols, vitamins and pigments, the determination of constitution in the case of haemoglobins and chlorophylls. Techniques have advanced that permit an approach, with confidence, to the problems of high-molecular weight substances, starches, proteins, viruses, enzymes, with weights ranging from 17,000 to many millions, that take us into the domains of the most complex biological systems. The development of the ultra-centrifuge by Svedberg has shown us that these biological systems retain the molecular characteristic, and, with the Tiselius electrophoresis apparatus, demonstrates in many systems the essential homogeneity of the material. Successively, the microscope, the ultra-microscope and, most recently, the electron microscope have increased the resolution of our observations on material objects, so that now it is possible to 'see' molecules, if they are as large as the viruses studied by Stanley, and trace the interaction, one molecule with another. The x-ray analysis of

fibers and of the simpler globular proteins is now under way and will supplement the analytic and synthetic efforts that characterize this field at the present time."

The need of cooperation in solving practical problems in agriculture was emphasized by Dr. R. W. Trullinger, assistant chief of the Office of Experiment Stations, of the U. S. Department of Agriculture. Before hay could be cured artificially with success a plant physiologist had to place the hay plant under the microscope and determine just what had to be done to bring about the internal changes in the plant to cause the curing. Once this was known the agricultural engineer could proceed with his mechanical manipulation of environment to cure the hay successfully even when the sun wasn't shining.

A discovery that promises to prove useful to biologists of the future was reported by Dr. Irving Langmuir, of the General Electric Research Laboratories. He has found that when very, very thin layers, only one molecule thick, are highly impermeable they have internal stresses, in which some part of the film is in the state of tension which is opposed by another part under compression. Permeability, or what lets things get through, is a property which gives a kind of fine structure of the monolayer.

Patients hopelessly sick with cancer which has spread to the bones from its original location in the breast or prostate gland are now being treated with radio-strontium, made by the atom-smashing cyclotron, was announced by the inventor, Professor E. O. Lawrence, of the University of California. It is too early to know what the results of this treatment will be, although favorable signs, including control of pain, have been observed. The cyclotron attack on cancer and other serious diseases now includes use of neutron rays, made by bombarding a beryllium target with high-speed deuterons, to treat cancer; use of radio-phosphorus for treatment of the blood diseases leukemia and polycythemia vera; and use of radio-iodine for treatment of tumors and enlargement of the thyroid gland. The idea of using radio-strontium for treating bone cancer arose from studies of the late Dr. Charles Pecher, of the University of California, who found through harmless tracer doses of radio-calcium and radio-strontium that strontium, like calcium, after it is taken into the body goes immediately to the bones, particularly to new-forming bone tissue and cancerous growths in bones, practically none of it being deposited elsewhere. Either strontium or calcium, therefore, could be used to carry cancer-killing radiation straight to cancerous bones. Radio-strontium is being used, because it can be made more easily in the cyclotron than radio-calcium. The small, harmless tracer doses of radio-calcium and radio-strontium also are giving information about the action of vitamin D in rickets. Vitamin D, these studies have shown, both promotes the absorption of calcium and in other ways promotes mineralization of bone.



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## THE DANGER OF ACCIDENTS AT HOME

THE most dangerous traffic hazards are encountered when you are on porches and outside stairs, according to Roger W. Sherman, editor of the *Architectural Record*, who reported to the Safety Congress, meeting in Chicago, ways in which home designers can reduce the chances of accident. According to Mr. Sherman, all parts of the house are not equally dangerous. The bathroom, contrary to popular opinion, is only a seventh as dangerous as porches and outer stairs, and, in fact, has the lowest percentage of accidents among the rooms in constant use.

Since most porch and outer stair accidents are falls, house designs should call for guard rails, non-slip treads, adequate lighting and an absolute minimum in changes of grade. Entrance platforms, for example, should be only one step above the grade wherever possible. If this is not possible steps and platforms should have guard rails and be effectively protected in some fashion from rain, sleet and snow.

"Porches and terraces likewise should be very near the finished floor level, and if rough surfacing is used joints ought to be smoothed sufficiently, so that there will be no danger of toe-stubbing or heel-tripping. It goes without saying that second floor porches ought to be protected with toe boards and railings high enough and sturdy enough so that children can not climb over them or push under them."

## AUTOMOBILE GEAR-SHIFTING TEST

AUTOMOBILE gear shifting may some day just happen when required under the direction of a "brain" of steel and wire. The autoist will merely have to make the momentous decision as to whether he wants to go forwards or backwards—and then just step on the gas.

That present trends are all in this direction was reported to the Society of Automotive Engineers by Harold E. Churchill, Studebaker engineer. He traces the history of how one function after another that had to be executed by the driver has been taken over by automatic devices, from cranking the engine, advancing and retarding the spark, to the present-day fluid drive. But even this last great improvement still requires the driver to change the gear ratio to what, according to his judgment, it should be under the circumstances. The shift is merely gradual and continuous instead of by sudden jumps.

Mr. Churchill, instead, has in mind a mechanism by which the gear ratio will be automatically changed without the attention of the driver, according as the speed and pull of the engine require it. He has it more than in his mind, for such mechanisms have already been constructed and tested in actual use. His report deals with these tests. He is not altogether satisfied with them. He points out a few defects. For instance, he says that the frequent automatic shifting of the gears in traffic is apt to be disconcerting to the driver. Something must be done about this. He recommends other improvements.

However, the mechanism in the main is here and only needs the removal of kinks, as disclosed by actual use, to become regular equipment of future cars.

## ITEMS

SOME equipment developed in the short space of one year's defense research has already seen trial under actual war conditions, according to President Karl T. Compton, of the Massachusetts Institute of Technology, who spoke at the One Hundred and Seventy-fifth Anniversary Celebration of Rutgers University. In a number of other directions the work of the National Defense Research Committee has been reflected in purchase orders for materials and equipment by the Army and Navy. Much equipment developed by the researches of some 5,000 scientific men has undergone field test by the military services. While those engaged in the governmental research on defense approach their work with the enthusiastic conviction that it is well worth doing, Dr. Compton stated that "in many cases there has been some inclination to doubt whether the armed services give adequate recognition to the significance of the results being obtained and show as much enthusiasm as could be wished about putting the results into production and use."

ALL colleges and universities in the United States have been urged to increase their output of technically trained young men to meet the estimated needs of the government during the next two years. An appeal has been sent out by the Civil Service Commission, accompanied by estimates of the number of new men that would be required in each special technique. Thus, in the field of physics, 295 specialists in radio, 304 in meteorology, 110 in ballistics, and 98 other specialists will be needed. In chemistry 233 experts in explosives, 144 in the metallurgy of manganese, magnesium and aluminum and 179 others will be needed. In engineering 916 mechanical, 812 industrial, 514 chemical, 443 electrical, 420 aeronautical and 1,355 other engineers will be required. In addition, 1,591 junior engineers, 3,424 engineering aides, and 4,113 engineering draughtsmen will be wanted. In medicine, 1,228 nurses and 636 physicians are required. Inspectors in all branches to the number of 9,218 will be required and an unestimated number of economists, business analysts and administrative technicians. The estimates do not include the number of men that will be needed by civilian industry to replace those drawn off by defense needs or the draft.

AN enzyme of the body which helps to prevent the squandering of foodstuff reserves is giving clues to some unsolved cancer riddles, it appears from the report to the American Chemical Society, in New York, of Dr. Kurt G. Stern, of Yale University School of Medicine. The enzyme has been christened the Pasteur enzyme by Dr. Stern and his associates, Dr. Joseph L. Melnick and Delafield DuBois, in honor of Louis Pasteur, French bacteriologist and chemist who discovered the power of oxygen to throttle fermentation processes and thus protect food stores of the body from needless destruction. It is the Pasteur enzyme which keeps the oxygen at this task. Otherwise food combustion in the body would be so uneconomical that each adult would have to consume daily more than ten loaves of bread to get enough energy for living.

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## SCIENCE NEWS

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## REFUELLING OF THE SUN

EVERY second the sun sweeps up something like 110,000,000 tons of hydrogen from the space through which it is passing, if a new astronomical theory is correct!

Other stars pick up similar amounts of the interstellar gas, and thus keep refueled. This is the suggestion of Dr. R. A. Lyttleton and F. Hoyle, Cambridge University astronomers. A summary of their theory, answering certain objections that had been made to it, is given in the latest issue of the *Monthly Notices of the Royal Astronomical Society*.

During the last few years astronomers have generally accepted the idea that the stars keep going by a transmutation process in which hydrogen turns into helium, giving off energy as it does so. However, it is stated that "the available astronomical evidence, particularly from double stars, led us to the view that a further potential source of energy must be introduced from outside the stars, either continually or intermittently replenishing the hydrogen in the star."

As it is now known that space between the stars is not the perfectly empty void it was once thought to be, but contains about as much matter as the stars themselves, in the form of diffuse clouds, they concluded that the stars might sweep up hydrogen from these clouds as they went through them. Though these clouds consist largely of calcium and sodium, which would not add to the stars' lives, as little as 10 per cent. of their mass in hydrogen in the form of molecules would suffice to keep the stars going. Recent observations have shown that molecules containing hydrogen actually are present in the cosmic clouds.

They also suppose that the cloud is irregular, and is concentrated towards the central plane of the Milky Way. Here, they calculate, the density would be such that a gram of matter (which is about a twenty-eighth of an ounce) would be contained in a cube some 1,300 miles on a side. Studies of other systems like the Milky Way have shown that they are about as dense as this in their centers. Dr. Lyttleton and Mr. Hoyle regard as supporting evidence for this idea the fact that the brightest and most massive stars are in the plane of the Milky Way. Evidently these pick up more matter and fuel than stars in thinner regions.

"The real need at present in this problem," they conclude, "is for trustworthy observations leading to information of the density distributions and velocities of the stars relative to the cloud." These might confirm the theory, disprove it, or require it to be modified. "At present," it is stated, "in regard to stellar evolution, the choice is between the consistent theory based on the idea of accretion and no theory at all."—JAMES STOKLEY.

## PHOTOSYNTHESIS

TEXT-BOOK theories of photosynthesis have been upset by the use of radioactive carbon, a product of the atom-

smashing cyclotron, in tracer studies at the University of California. This product was used by Dr. S. Ruben, of the department of chemistry, and Dr. M. D. Kamen, of the Radiation Laboratory, to test former theories of plant chemistry.

A new and as yet unidentified compound that does what formaldehyde was supposed to do has been discovered. All animal life depends on the ability of plants to convert inorganic elements into organic forms that can be assimilated by animal organisms. Any animal, from man to microbe, would starve if soil, water and air, primary storehouses of nature's supplies, were his only source of food. But plants can use elements in the raw and by a mysterious chemical process involving chlorophyll, a green coloring matter, change basic elements into sugars, starches, proteins, vitamins and other organic foods according to their kind. This process is known as photosynthesis.

The mystery of photosynthesis has long baffled scientists, and though theories on the process have been offered, none could be proved because chemical methods of proof were inadequate. The most widely accepted theory of photosynthesis was that plants take carbon dioxide, light and water and produce formaldehyde. This process, common to all plants, was supposed to be an intermediary step, preceding the chlorophyll action that produces carbohydrates and other nutritive substances.

Dr. Ruben and Dr. Kamen placed algae plants in chambers containing radioactive carbon in a carbon dioxide compound. Leaves of the plants literally pulled the charged element from the air and its course through the plant could then be followed. If the old theory were true, the tagged carbon should appear in the formaldehyde formed by the plants, but this substance extracted from the test plants contained none of the active carbon. An unsuspected compound was discovered, however, that contained most of the charged carbon the plant "breathed"—the true intermediary step in photosynthesis. The chemical formula of this important compound has not yet been determined, but scientists are hard at work on this problem.

Dr. Ruben, Dr. Kamen and their associates also disprove the theory that photosynthesis is a process carried on exclusively in the light. They found that some phases of the process may be independent of light, for plants continued to assimilate charged carbon dioxide in total darkness.

## INDEPENDENCE OF FOREIGN IMPORTS

THANKS to research, Americans in this World War era are remarkably independent of foreign-made goods compared with "the deplorable condition of this country in 1914," according to Dr. James K. Hunt, of E. I. du Pont de Nemours and Company, who spoke before the Twenty-Eighth Annual National Business Conference.

In World War I the United States depended on a

Japanese monopoly for camphor, important in medicine, plastics, and photographic film. Now, American chemical industry makes about 80 per cent. of our camphor.

In 1914, we depended on getting natural bristles from abroad. "To-day," said Dr. Hunt, "bristles better than any hog bristles from the Orient are being made from the same nylon used in the manufacture of hosiery."

Fine optical glass, in 1914, came from Europe, for important war and peace instruments. Now "this country is producing optical glass of quality second to none in the world."

Automobile tire treads made from certain of the so-called synthetic rubbers developed by research were pronounced the equal of the best natural rubber in resisting abrasion. America has virtually inexhaustible supplies of the basic raw materials for making these rubbers.

As recently as 1931, said Dr. Hunt, 42 materials were listed as strategic, but only 14 are on the most recent list by the Army and Navy Munitions Board, and some of these are "less strategic" now because of recent scientific achievement.

### HOSPITAL SERVICE IN GREAT BRITAIN

A REVOLUTIONARY step in Britain's health program, making available comprehensive hospital service to every person needing it, will soon be taken, was reported by Sir Wilson Jameson, chief medical officer of the British Ministry of Health, at the Atlantic City meeting of the American Public Health Association. By this plan, patients will pay for services if able, but the service will be available to all regardless of ability to pay. Part of the cost will be met by counties and large towns and part by the national government.

All hospitals, voluntary and tax-supported, are now unified in one national hospital system, Sir Wilson pointed out, although few realize it. This came about because the government took over some existing hospital beds and added new ones in preparation for expected war casualties and reallocated the hospital staffs for efficient service during the emergency. The new step shortly to be taken will insure that the gains from this unification of hospitals will not be lost after the war.

The health of the English people has not suffered and in some ways has improved during two years of war, Sir Wilson declared. Cases of nervous and mental disease of psychoneurotic type are actually less among the civil population than they were before the war. With the exception of meningitis, infectious diseases have not occurred. Cooperation of the public in boiling water and efficiency of sanitary engineers in repairing water mains and sewage systems have prevented typhoid fever epidemics in spite of the endless number of times water mains and sewers were bombed and water contaminated in air raids.

Sir Wilson stated that large numbers were saved from death by bombing through the evacuation of children from "target towns." This evacuation policy also helped to keep down epidemics, as those evacuated were in the age group most susceptible to many communicable diseases.

The chief lesson for America to learn from England's war health experiences, it appears, is to build up adequate maternal and child health facilities and improve housing in even the smallest towns and rural communities. The excellence of the English health facilities, built up between two World Wars, and the rehousing during the same period of millions in individual homes contributed largely to the good health which has been maintained through evacuation of cities, air raids and the accompanying disruption and destruction of the war.—JANE STAFFORD.

### CONTROL OF THE IMPORTATION OF TYPHOID

DISCOVERY of typhoid fever patients and healthy carriers of the disease among more than a score of European refugees recently arrived in New York City, Newark, N. J., and Buffalo, N. Y., led the International Society of Medical Health officers, meeting in Atlantic City, to request Surgeon-General Thomas Parran, of the U. S. Public Health Service, to take steps to prevent further importation of disease from abroad.

Specifically the society requested, in a resolution introduced by Dr. Charles A. Craster, health officer of Newark, N. J., that the Surgeon-General institute at all ports of entry comprehensive laboratory tests for detection of persons who have, or are carriers of, typhoid fever so that they may be kept from introducing the disease into this country. Costs of the procedure should be borne by the shipping companies which, according to the resolution, are now charging exorbitant fees for passage through the war zone.

At present U. S. Quarantine officers detain only those incoming passengers showing a rise in temperature and notify health officers of cities to which other refugees are bound. This is not effective, Dr. Craster charged, because when the local health officers try to locate the refugees, they are not to be found at the addresses given by shipping companies and immigration officials.

More rigid inspection of passengers at ports of embarkation and refusal of landing permits for ships with inadequate space and sanitary facilities for passengers or for ships whose captains or surgeons make false statements as to cases of disease occurring during the voyage, was also requested in the resolution.—JANE STAFFORD.

### VISION AND VITAMIN A

If your diet is extremely deficient in vitamin A for just one day, night blindness may result that will increase your accident-hazard in night driving. This discovery was made by psychologists at the University of California under the direction of Dr. C. W. Brown, associate professor of psychology.

Ten students were tested and Dr. Brown divided them into two groups. One group ate foods with high vitamin A content for 12 days. The other group omitted A-containing foods from their diet. Then each group reversed the diet program for another 12 days. At the end of each 12-day period students' eyes were tested by an apparatus developed by Dr. Brown for quick testing of glare blindness. A light was flashed in front of students' eyes

for a short period, then the time for "vision recovery" was measured in a nearly dark room. Those who had been on a high vitamin A diet recovered from glare blindness in 18.03 seconds, while those with vitamin A deficiency took 22.70 seconds to adjust their eyes to dim illumination.

After one group on the excessive A diet switched to the deficient foods, their more rapid recovery time from glare blindness was lost within one day. When the other group began their deficiency diet, the glare-recovery time became longer gradually until the fifth day, then remained the same throughout the rest of the 12-day test.

The difference between the glare recovery time of the two groups was not great; 4.76 seconds, but enough to be significant. While the small number of students used in the tests does not permit any final conclusion on the exact time required for vitamin A deficiency to affect night blindness, the results are significant.

### AUTOMOBILE OWNERSHIP

ACCORDING to government statisticians, the average farm, village or small-city family of good income now spends more on automobile transportation than on any other item except food and housing.

It is said that an American would rather give up his home than his car. This is an exaggeration, but the investigation shows that families are willing to give up other things to make a place for the important automobile.

Nine families in ten in American cities and towns of all sizes own a car, if they have an income above \$2,500. Farm families have become so automobile-minded that relatively more such families own cars than families living in villages and small towns.

Leading items in American family budgets in villages and small cities used to be food, housing, household operation and clothing. Now, the family in good circumstances tends to spend as much or more on the car than on clothing—if the family lives in a village or small city.

Automobile ownership increases with ability to pay, but the used car market has extended car ownership, especially at lower income levels. While used cars are more commonly bought by low income families, in families as high as the \$3,000 to \$4,000 income class one third of farm autoists drive used cars, and one fourth to one fifth of the village and small-city drivers are used car owners.

The survey, intended to provide comprehensive facts about the income and consumption habits of American families, was made by the U. S. Department of Agriculture in cooperation with the WPA, and the results compiled form a government booklet entitled "Family Expenditures for Automobile and Other Transportation."

### ITEMS

MOTION pictures of fiery gas in the atmosphere of the sun large enough to cover the entire United States and whirling at a speed of 120,000 miles per hour are described by Dr. Edison Pettit, of the Mount Wilson Observatory, in a report to the Astronomical Society of the Pacific. The photographs were taken with a new type of

instrument, an interference polarizing monochromator, that had not been previously used in this work. When first seen the solar tornado was 8,000 miles wide at its base and 38,000 miles high. A smoke-like column projecting from its top reached an elevation of 68,000 miles after which it bent over and returned to the sun's surface. During the course of the observations a knot of gas broke away from the top and was ejected upward with a speed of 130,000 miles per hour. About two hours later the whole vortex started to rise, losing its spiral structure but remaining attached to the sun by two fine streamers. It finally faded from sight completely.

STREAMS of neutrons, unchanged fragments of atoms smashed in the University of California cyclotron, have produced hereditary changes in living organisms, in experiments carried out by Dr. Everett Ross Dempster. As experimental material, Dr. Dempster used the familiar fruit fly. He exposed male insects to the neutron stream, then mated them with untreated females and watched their offspring for mutations, or abrupt evolutionary changes. He found that neutrons are more effective than x-rays in producing certain types of mutations, less effective in producing others.

DEFENSE priority ratings for materials needed in the commercial manufacture of two vitamins have been obtained so that no shortage in these strategic chemicals will occur, according to an announcement made by Dr. W. H. Sebrell, of the U. S. Public Health Service, to the American Public Health Association meeting at Atlantic City. The two vitamins concerned are vitamin B<sub>1</sub> and riboflavin. The latter is needed for protection against an eye disorder that may destroy vision. It is difficult to obtain an adequate supply of this vitamin from the diet unless plenty of milk is taken every day. Nutrition authorities therefore believe it would be advisable to add this vitamin to enriched bread and flour as soon as an adequate supply of the synthetic vitamin is available. Synthetic vitamin factories are now working to increase production of both riboflavin and thiamin, which is the synthetic vitamin B<sub>1</sub>. When large-scale production is under way, Dr. Sebrell said, the addition of riboflavin, thiamin and pellagra-preventing nicotinic acid to white flour and bread will cost no more than the addition of thiamin and iron does now.

FRUIT crops are being greatly benefited this year by sprays of various growth-promoting substances, notably naphthalene acetamide and naphthalene acetic acid, according to F. D. Jones, of the American Chemical Paint Company, Ambler, Pa. Apples and pears are induced to hang onto their twigs longer, assuring better crops; premature bud development in peaches is checked until danger of late frost is past; oranges are ripened two weeks earlier. In experimental sprayings in the South, cotton yields were increased by half. Under certain soil conditions, yields of corn, peas and beans have been doubled. Certain vegetables in storage, like potatoes and onions, are restrained from sprouting.

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## SCIENCE NEWS

*Science Service, Washington, D. C.*

## THE SUPPORT OF FUNDAMENTAL SCIENCE

EACH one of us has a tremendous stake in the future of fundamental science. To millions of people, the stake is life itself, for advance in medicine, sanitation and public health, which gives life to millions, depends upon fundamental science. We are all familiar with the material conveniences and comforts which science has given us, but we often forget the original patient, fundamental research which made them possible and will be the basis for future advances.

The scientists who carry on fundamental research are like explorers. They are continually seeking to push forward the frontiers of knowledge, by discovering basic principles and how some law of nature works. Their discoveries are the raw material of applied science. If their kind of research should end, then progress in all applied science would presently end also, just as the water fails when the spring runs dry.

We forget the significance of fundamental science sometimes, just as we forget that fundamental science can not support itself, since even the greatest of these basic discoveries can not often bring to the scientist or to his institution any immediate return in money. For this very reason, the greatest part of such research in this country is carried on in our universities and in a few specially endowed research institutions. (Industry and government incline toward *applied* research—the application of some fundamental discovery to immediate problems.)

To-day fundamental science is confronted by a serious problem: universities and research institutions in general have been hard hit in recent years by reduced earnings on their endowments at a time when gifts and bequests have fallen off sharply. These institutions no longer have the funds to finance much essential research. As a result, fundamental science is receiving less support to-day than at the end of the 1920's.

To help supplement existing support for science, the National Academy of Sciences has created the National Science Fund—a national clearing house for advice on philanthropy in science. In every community there are many persons who would like to make large or small gifts for science, but who hesitate because they do not know how it can be done effectively. Sometimes they feel that the amounts which they can afford to give would be of slight assistance to science.

Through the National Science Fund, any donor may obtain the advice of those scientists best qualified to assist him in making a useful gift to science. If he wishes, the fund will administer his gift for him. Through the fund, many smaller gifts may be pooled to accomplish large results. The National Science Fund does not carry on any research of its own, but acts through those institutions and scientists best qualified to undertake the research at any given time.

Scientists to-day have great faith in the infinite possi-

bilities of science in the future. So do countless laymen. Through the National Science Fund, every one—scientist or layman—can share in the adventure of exploring these unknown realms.—WILLIAM J. ROBBINS.

## VARIABLE STAR OBSERVERS

SOME 850,000 observations of about 600 stars have been made in the past thirty years by members of the American Association of Variable Star Observers, is reported by Leon Campbell, recorder, in his annual summary of the researches of this band of volunteer astronomers scattered all over the world.

Veteran watcher of the fluctuating light of these stars is the Reverend T. C. H. Bouton, who has observed during the whole thirty years of the existence of the association, first from Hudson, N. H., and now from St. Petersburg, Fla. At the age of eighty-five years he is still adding to his grand total of 25,000 observations.

L. C. Peltier, of Delphos, Ohio, known for his comet discoveries, has been observing steadily since 1918 and has nearly 60,000 observations to his credit.

E. H. Jones, of Goffstown, N. H., has been keeping track of variables since 1923 and has made 40,000 observations. J. M. Baldwin, of Melbourne, Australia, has made nearly 35,000 observations since 1920, and R. G. Chandra, of Bagehar, India, follows with 29,000 estimates made during the past twenty-one years.

The volunteer astronomers of the American Association of Variable Star Observers, sponsored by Harvard Observatory, spend most of their effort in observing the stars that are inconstant in their light. Small telescopes are used for this purpose and there is opportunity for additional observers who will have special stars assigned to them as they prove their competency. They also watch and compute occultations of the moon and search for bright, suddenly appearing novae or "new stars."

In the past year, 38,043 observations of variable stars were made, with Cyrus F. Fernald, of Wilton, Me., first, with 3,133 observations.

## THE REMOVAL OF REFLECTIONS FROM THE SURFACE OF LENSES

A NEW chemical process that can wipe troublesome reflections off the glass of show windows, pictures, camera screens and lenses and airplane instruments has come out of current RCA television research and a clue that was dropped in 1900 by Lord Rayleigh, the English physicist.

The new method, developed by Dr. F. H. Nicoll, of the RCA Laboratories, is to expose the glass surface to hydrofluoric acid vapor. This vapor etches away a small amount of surface and leaves a thin, transparent film of calcium fluoride about one quarter of a light wave-length in thickness.

This almost invisible film not only abolishes most of the reflection from the surface, but the light that otherwise would be lost in reflection is saved and transmitted

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through the glass. Thus the very thin film is of great usefulness in speeding up lenses used in photography and television. Happily, tests show that the film formed by the hydrofluoric etching is very tough, withstanding washing with such things as water and alcohol. It can be heated safely to high temperatures. It is purple in color, showing that yellow and green, to which the human eye is quite sensitive, are not reflected.

This discovery was made during experiments to improve contrast of television cathode-ray tubes. It promises to allow television to be viewed in rooms that are not quite so dark as heretofore required. Television images are light-painted on the glass face of the cathode-ray tube, passed through a glass protector plate and then reflected from a mirror. In each case reflection cuts efficiency unless the new film is used.

Very thin coatings have been successfully used in the last few years to suppress reflections from glass surfaces as a result of researches by Drs. John Strong, Katherine Blodgett and C. H. Cartwright. In these earlier processes coatings of various sorts have been added to the glass, while Dr. Nicoll's method etches the glass to produce a film. Commercial applications of the new process are being developed.

Lord Rayleigh more than forty years ago jotted down in his records that hydrofluoric acid diluted in 200 parts of water took off a layer of glass each hour amounting to about a quarter wave-length of light. This was the clue used by Dr. Nicoll in developing his new process of making glass more transparent.

### INSULIN SHOCK TREATMENT FOR MENTAL DISEASE

VITAMIN B<sub>1</sub> (thiamin) is now being used to make the insulin shock treatment for mental disease safer and more effective, is reported by a California investigator and three physicians at Harlem Valley State Hospital, at Wingdale, N. Y., where this dramatic treatment was pioneered several years ago.

By far the most dangerous complication which may occur in giving the insulin shock treatment is when the patient goes into a state of "protracted shock," failing to come out of it until damage to the brain has occurred or perhaps even death. Yet when patients can be brought out of this dangerous state, it is sometimes found that they have been cured of their mental disease.

That it has been now found possible to predict "protracted shock," prevent it, or even to produce it at will, is reported by Dr. Jacob P. Frostig, of the Medical School of the University of California, and Drs. I. Murray Rossman, William B. Cline, Jr., and Oscar Schwoerer, of Harlem Valley State Hospital.

So far no dependable method has been found for terminating the condition once it has developed, so these physicians have made no use of their knowledge of how to produce it for therapeutic purposes.

Insulin, when given in shock doses, follows a special course in its effects on the central nervous system. First, the cortex of the brain is affected, then the basal ganglia and hypothalamus, then the midbrain and finally the medulla oblongata. Various recognized symptoms accom-

pany the successive involvement of these different parts of the nervous system.

Study of cases of protracted shock revealed that this condition occurs only after the medulla oblongata has been involved for some time. The dangerous protracted shock can be prevented in three ways. The treatment can be terminated as soon as the signs of medullary involvement occur. If the symptoms should develop too rapidly to be prevented, the patient can be given an injection of glucose into the veins. In the case of patients who show a special tendency to the protracted shock, vitamin B<sub>1</sub> will prevent it if given regularly. Even after protracted shock has developed, it was found that injections of the vitamin in doses of from 3,000 to 10,000 units will shorten the period of unconsciousness.

### SCIENTIFIC STREET LIGHTING

TRAFFIC fatalities in our cities are more frequent at night than by day. The reason is inadequate and improper lighting, according to Louis J. Schrenk, general superintendent of the Public Lighting Commission, of Detroit.

When this is replaced by a scientifically planned system of lighting, Mr. Schrenk told the Illuminating Engineering Society, meeting at Atlanta, night fatalities diminish and approach the daytime figures. It is quite possible, he indicated, to make city streets as safe by night as they are by day, and it costs but little more than the extravagant and wasteful methods that have been employed. These facts were brought out by an investigation of conditions in Detroit before and after the installation of a scientific lighting plan.

On 100 miles of heavy traffic thoroughfares, night fatalities had amounted to nearly 80 per cent. of the total fatalities. When these streets were equipped with "Traffic Safety Lighting," the night fatalities fell to about 60 per cent. of the total.

In 1930, the city operated 28,000 street lamps at a *per capita* cost of 91 cents per year. In 1940, with safety lighting installed on most of its streets, the city operated 40,121 street lamps at a cost of \$1.02 *per capita*.

When the modernization program is completed—it is now only 55 per cent. complete—the commissioner stated that the *per capita* cost would be around \$1.35. But further reductions in the proportion of night to day fatalities is expected.

The heart of the improvement is the new "traffic safety lamp," designed after much investigation and many tests on the streets. By a combination of reflector and prisms, this lamp throws its main beam at an angle of 78 degrees, which is 8 degrees higher than the previous "Recommended Practice." This secures better illumination between lamps. The prisms redirect the light so that most of it falls on the street and a less amount along the sidewalks. The reflector cuts off the light at the building line.

Comparison of the new with the old lamps, both of the same brightness, showed that to secure approximately the same results with the old lamps more than twice as many of them would have to be used.

## PYRAMIDS AND RUINED CITIES?

EXPLORING Egypt's pyramids is "out" these days, but stay-at-home archeologists who have been excavating American pyramids, at Metropolis, Ill., report finding archeological treasures as rich as those of Egypt.

Pyramids, stone slab coffins and palisade defenses which figured in prehistoric Indian life and death have been unearthed at the Kincaid mound site, according to Dr. Fay-Cooper Cole, University of Chicago anthropologist, who has been directing the summer digging. For eight years the university has worked at a 500-acre area probing its buried history.

The half-dozen larger mounds were pyramids built by Indians carrying the clay in baskets, with a view to raising high places for ceremonies, explains Dr. Cole. On the flat tops they built temples of wood and thatch.

"Many people think that they must go to Egypt for pyramids or to the Near East for ruined cities, but we have both within the borders of this state."

Evidence that the Indians of the region were farmers has been found. They raised corn and beans, but also depended on hunting and fishing. Fearing invaders, they built a palisade with bastions around their community. Still sought is their main burial ground, but single graves which look like stone coffins have come to light. The bodies were laid in the stone boxes formed by the large stone slabs.

More than 100,000 Indian relics, including quantities of pottery, have been recovered from the site, and are being studied at the laboratory of anthropology. There is hope of detecting the exact time when the mounds were in use, by fitting pieces of wood from the site into a tree-ring calendar such as has been used in dating Indian settlements of the Southwest.

## THE SOVIET PRE-WAR CENSUS

SINCE Bible days, censuses have been valued in gauging a nation's fighting power, and the Soviet Union reports that its 1939, just-pre-war, census is now important aid in the struggle against Nazi invasion.

Whereas old-time head counts were relied on mainly to show how many men could be mustered, now in total war the number and location of such resources as thousands of miners, seamstresses and truck drivers become facts of vital usefulness.

The Soviet Union gained 16 per cent. in numbers in the twelve years between censuses, according to the figures for 1939. There are 6,000,000 fewer farmers, but machines are doing more of that work. A Soviet trek to the cities in general doubled city population. Industrialization has drawn so many people to cities and centers where natural resources are developed that nearly half the people are reported to be factory workers or to belong to families supported in this manner.

The pre-war census gave the Soviet Union a total population of 170,467,000, a figure which had risen to 193,000,000 at start of the present Nazi invasion, due to Baltic and Finnish additions, and which is now in a continual state of wartime flux.

When the census was taken, Soviet Union officials counted on 305,000 architects, engineers and industrial

designers, or almost ten times as many as in 1926. Farm crop experts numbered 90,000. Metal workers counted by enumerators numbered 4,331,000, or more than four times as many as 12 years before. Instrument and die makers had increased from 11,300 to 137,600. New to a Russian census were 15,000 armature winders and 8,800 excavator operators.

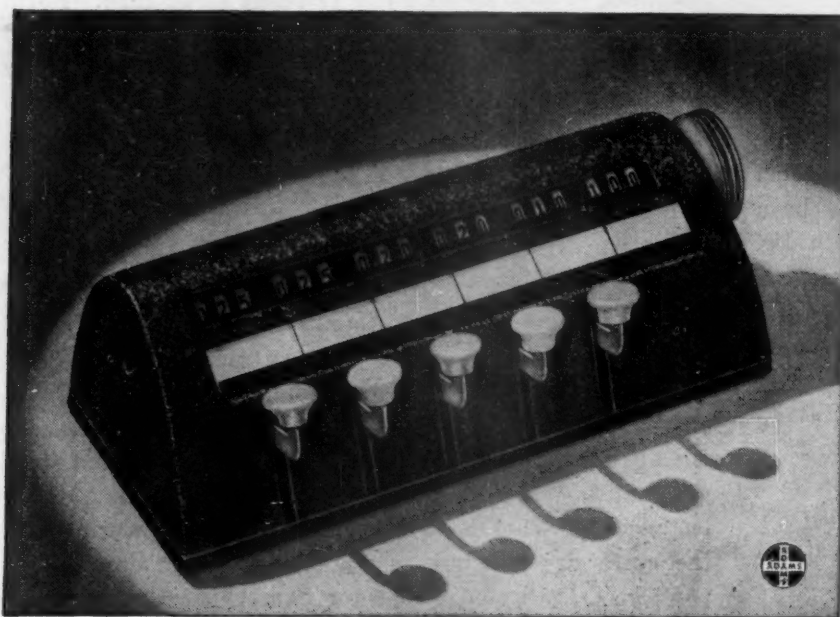
## ITEMS

NINE out of ten persons who once would have died of pneumonia now are saved, thanks to the sulfa drugs and the development of serum for the thirty-two different types of pneumonia, according to Dr. Edmund F. Foley, of the University of Illinois College of Medicine. Reducing the pneumonia death rate from 50 per cent. to 5 per cent. is "the outstanding medical achievement of the last decade," but he warned that even with serums and the sulfa drugs, early treatment for pneumonia is imperative. Pneumonia, in three fourths of the cases, begins with the patient "half-sick" with what is thought to be a cold. Several days may pass, days which are valuable for treatment, before the disease is recognized and medical aid sought. In only a fourth of the cases does pneumonia start explosively with chill, fever, pain, cough and prostration.

NEW use for sulfapyridine, saving eyes attacked by a highly destructive type of ulcer, was announced by Dr. Cecil W. Lepard, of Detroit, at the Chicago meeting of the American Academy of Ophthalmology and Otolaryngology. Dr. Lepard urged that no time be lost in beginning sulfapyridine treatment. The 48 hours required for a laboratory report on the type of infection is too long, he said, to wait before starting the treatment if the eye is to be saved.

EYE injuries in American industries are occurring at the rate of 1,000 every working day and 98 per cent. of them are wholly unnecessary, according to a study sponsored by the National Society for the Prevention of Blindness (Columbia University Press). It was found that about 1,000 workers lose sight of one eye and 100 or more the sight of both eyes in a year as a result of occupational hazards. Many more have damaged sight. It is pointed out that there is no need for the blinding of workers in American industry. The industrial accident and disease hazards affecting the eyes are now commonly known. Methods of eliminating these hazards or of protecting workers against them have been thoroughly demonstrated. Devices which provide protection against almost every type of eye accident are now available.

SPECIAL high power mercury arc lamps that have been developed by optical engineers to speed up the production of blueprints—needed in vast quantities in defense work—were described by Wm. T. Anderson, Jr., of the Hanovia Chemical and Manufacturing Company, Newark, N. J., at the New York meeting of the Optical Society of America. The lamps give a very high intensity of light in the near ultra-violet region to which the sensitized paper is most responsive. By thus shortening the exposure, the reproduction of working drawings is speeded up.



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## SCIENCE NEWS

*Science Service, Washington, D. C.*

## THE AGE OF THE SUN AND STARS

THAT the sun is only two billion years old, and will probably live to the age of twelve billion, is the opinion expressed by Dr. George Gamow, professor of physics at George Washington University, in an interview during the General Electric Science Forum program broadcast from Schenectady on October 28.

"Probably the best proof," Dr. Gamow said, "of the view that the entire stellar world had a definite beginning in some distant past can be found in the observations of Dr. Hubble, of the Mount Wilson Observatory. His results indicate that the large stellar groups, known as island universes, and similar in their nature to our stellar system or Milky Way, are receding from each other at a rather high speed. From the observed velocity of the recession, one can easily calculate that the separation of these giant stellar clouds must have taken place only about two billion years ago." At some period before that time, the matter of the stars formed one continuous mass of hot gas. "The epoch when this primitive gaseous chaos was broken up by the process of progressive expansion into the separate stars can be truly considered as the period of the physical creation of the world. In particular, the formation of our earth, which, according to geological data, is just about two billion years old, also falls within the same period."

Dr. Gamow rejected the hypothesis that the distances between the stars had always been substantially what they are now and that the earth and the other planets had been formed in a violent collision between our sun and some other star. Calculations show, he said, that such an event is then so extremely improbable that hardly more than one collision could have occurred during the entire past of stellar existence. If, on the other hand, the stars two billion years ago were very close together, collisions would have been frequent, and suns accompanied with planets would now be the rule rather than a most extraordinary exception.

Dr. Gamow pointed out that the sun lives by the alchemic conversion of hydrogen into helium. This is the source of its light and heat which it expends so lavishly. It is atomic power on the grand scale—which we on earth have only succeeded in imitating microscopically. It is the same with the other stars. Since hydrogen is the fuel of the stars, their probable life spans can be predicted on the basis of how much they have on hand and how fast they are expending it. Our sun is now about 35 per cent. hydrogen, and at the present rate of consumption this will last for another ten billion years.

## SUNSPOTS

THE coming minimum in the eleven-year solar cycle expected to occur within the next three years will give astronomers a chance to check again on one of the sun's greatest mysteries—the sudden reversal in the magnetic polarity of sunspots. Dr. Seth B. Nicholson, of the

Mount Wilson Observatory, in a report to the Astronomical Society of the Pacific stressed the importance of future research in this field.

So far the effect has been observed only three times. Although discovered twenty-nine years ago by the late Dr. George Ellery Hale, formerly director of the observatory, no satisfactory explanation of the phenomenon is known.

Dr. Nicholson explained that sunspots almost always occur in pairs having opposite magnetic poles, like the ends of a horseshoe magnet. At present in the sun's northern hemisphere the western half of a spot-group has a polarity like the north-seeking pole of a magnet. But this condition will be reversed for spot-groups of the new cycle if they behave as they have at previous minima. He concludes that "despite the fact that we have accumulated a vast amount of exact information about the way sunspots behave, we still know very little about what makes them behave that way. We may reasonably hope that some of the most fundamental questions of physics, chemistry and astronomy may be illuminated by an intensive study of solar magnetism."

## SILVER AS A SUBSTITUTE FOR COPPER IN ELECTRIC WIRING

SILVER, now lying idle in government vaults, could be economically substituted for copper in the electrical equipment of the new aluminum and magnesium plants now being built and thus help to relieve the present acute shortage of copper, was pointed out by Robert E. McConnell, chairman of the Engineers Defense Board, New York City, in an address to the American Institute of Chemical Engineers at Virginia Beach.

The government owns 100,000 tons of silver, Mr. McConnell continued. Silver is an even better conductor of electricity than copper. It would cost very little to convert the government ingots into bus bars and wire. The silver would be as safe as in the vaults. The plants will operate twenty-four hours each day. They will be guarded. Besides, the wires will be alive all the time. When the emergency is over the silver conductors can be replaced by the more conventional copper ones, and the silver put back into the vaults.

Twenty-five thousand tons of copper could be saved in this way in the new aluminum and magnesium plants, and another 50,000 tons could be saved in the same way in other plants requiring large conductors of electricity. The shortage of copper will cause more inconvenience and dislocations than will be caused by any other shortage. It has become acute in the last six months and the prospects are that it will become worse. Recent estimates are that the total productive capacity of the Western Hemisphere south of Canada will be required for military purposes alone.

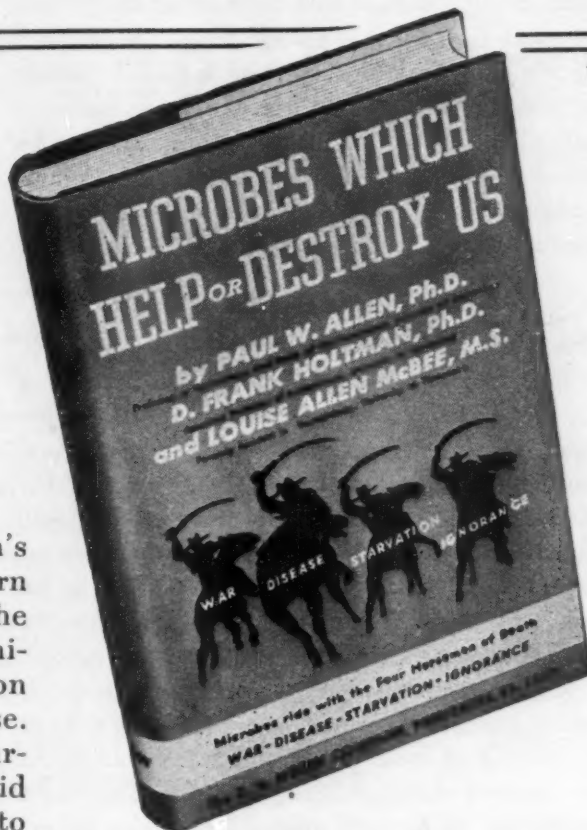
Current production of new copper in the Western Hemisphere is 1,600,000 tons a year, an all-time peak. Non-defense needs run about 1,000,000 tons a year. But 1,

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### TOOTH DECAY

DEAF SMITH COUNTY, in the Texas "panhandle," may give the world a chemical formula for preventing tooth decay, it appears from preliminary studies reported before the Houston, Texas, meeting of the American Dental Association, by Dr. Edward Taylor, director of the dental division of the Texas State Department of Health.

The sound teeth of residents of this county so impressed a dentist in one of its towns, Hereford, that he suggested a study of local food and water intake might prove valuable. Following this suggestion, the teeth of 43 native-born continuous-resident persons in and around Hereford, chosen at random by a teacher and an NYA worker who knew nothing of local conditions, were examined. Not a single decayed tooth or filling was found in the teeth of these people, whose ages ranged from two years to past middle age. Equally if not more impressive was the finding that people who moved into the county from other states, with the usual number of cavities and fillings, after having lived there a few months ceased to develop further caries. Even a few cavities in teeth brought there as much as five years previously with active decay had ceased to be active and the cavities had acquired hard, glazed floors and surfaces.

Tooth decay in Deaf Smith County, according to conclusions reached so far, is only about half as much as the lowest amount heretofore reported in the United States and much lower than the average.

Deaf Smith County is part of a high level plain, the top soil a dark, sandy loam, below which there is clay containing a high percentage of calcium carbonate. Moreover, wheat ground in Hereford mills has a high protein content, and is about six times as high in phosphorus as the average standard flour. Milk samples at a local creamery contained 30 per cent. more phosphorus than accepted standards.

"This indicated that possibly all vegetables, dairy and meat products of the area are comparably high in these elements so necessary to building and maintaining tooth tissue." Dr. Taylor noted that every rural and many of the urban homes have one or more windmills, drawing water from a depth of 70 or 80 feet—water that has abundant fluorine and calcium. He believed that a formula could be arrived at which would produce a high degree of immunity to tooth decay by the proper combination of fluorine, phosphorus, calcium, vitamin D and possibly other factors in the food and water intake.

### ITEMS

THE number of machines produced in the United States last year shot up from a normal annual production of

25,000 to 100,000. By the end of this year production is expected to approach the 200,000 mark, according to a report issued by the National Machine Tool Builders Association. Such great advances have been made in the speed, power and efficiency of cutting tools and in the design and degree of automatic operation of the machines employing them that new machines are estimated to be on the average three times as productive as machines of older designs.

DANGEROUS static electricity that develops on automobiles can be reduced by injecting two grams (15 grains) of a special conducting powder into the inner tube through the valve stem, according to a report by S. M. Cadwell, N. E. Handel and G. L. Benson, of the United States Rubber Company, to the American Chemical Society. The powder distributes itself and adheres to the walls of the inner tube, forming a continuous conducting layer. This does not prevent the generation of static electricity on the tire tread, but the negative charge on the tread induces a positive on the conducting layer, and the strong attraction between these two charges of opposite sign reduces the charges that would otherwise be induced on the body of the car. Road tests of cars whose tires have received this treatment reached a maximum of 1,200 volts on the car, and the charge disappeared quickly on standing. This is to be compared with 5,000 to 7,000 volts generated on cars whose tires had not been treated.

MINUTE structures in the tiny anatomy of an insect, hitherto unknown and unsuspected, have been disclosed under the hundred-thousand-fold magnification of the electron microscope, in the RCA laboratories. The breathing tubes in the sides of a mosquito's body are shown to be lined with elastic hoops a fifty-thousandth of an inch broad. These in turn are covered with sub-microscopic spines less than a quarter-millionth of an inch high. Other submicroscopic studies are being made on skin, wings and bristles of butterflies, bees, flies, beetles and cockroaches. The powerful instrument is being used to disclose details of the shells of their tiny eggs.

ENGLAND had the highest marriage rate in its history last year, according to the report of a statistician of the Metropolitan Life Insurance Company. The marriage rate was nearly 30 per cent. above pre-war level. The birth rate this year is continuing a downward trend, but the decline that was slight last year is now a sharp drop. In the first six months of 1941 the birth rate in England's cities fell off 20 per cent. compared with 1940. Infant mortality this year is high in England, because communicable diseases have been prevalent. Measles was abnormally prevalent in the first half of 1941 and whooping cough, also. Diphtheria cases were increasing to a lesser extent. These conditions have improved considerably during the summer, however, aside from the whooping cough situation. Civilian air raid deaths for all England in the first eight months of 1941 were 19,078. Deaths from bombing during August were 169, or less than the daily average during April and May.

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### INTELLIGENCE, POWER AND PERSONALITY

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Here is a story of modern medical research, a picture of the many-sided fight for health, glimpses of the laboratories, of the clinics, of medical science at work on a score of fronts. There are accounts of the stratagems which have postponed death, banished pain, fortified the body against countless invisible enemies, rescued lost minds and brought them back to sanity—the epic of man embattled against disease.—*Scientific Book Club Selection*.

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## SCIENCE NEWS

*Science Service, Washington, D. C.***SOME PAPERS READ AT THE BOSTON MEETING OF THE AMERICAN COLLEGE OF SURGEONS**

THAT beef blood serum and plasma can be made safer for transfusion to human patients by a method of pre-treatment with human red blood cells was announced by Dr. Arnold J. Kremen, of the University of Minnesota Medical School, at the meeting of the American College of Surgeons, which opened on November 4. He stated that substances in the beef blood plasma and serum which might cause dangerous clumping or equally dangerous dissolving of the red cells in the patient's blood can be removed by previous absorption on human blood cells. Beef serum treated in this way caused reactions to transfusions in 24.5 per cent. of the patients, compared to reactions in 52 per cent. following transfusions with the untreated beef serum. With untreated beef plasma there were reactions in 66 per cent. of the patients.

DIAGNOSIS of overactivity of the thyroid gland in the neck, commonly thought of as goiter, may be improved by a new test, according to results reported by Dr. Marvin Smith, Dr. Willis H. Jondahl and Dr. Alton Ochsner, of the School of Medicine of Tulane University of Louisiana. The test will be most valuable, it appears, in those patients with overactive thyroid glands who do not show a goiter and whose basal metabolic rate is normal, instead of being higher than normal. In such cases, with only a few symptoms to suggest thyroid gland disease, it is difficult to diagnose the condition accurately and to give proper treatment. The result may be irreparable damage to other organs whose activity is influenced by the thyroid gland. The test, which is based on findings of Dr. T. L. Althausen, of San Francisco, is made by giving the patient a little more than an ounce of galactose dissolved in water. Galactose is a sugar-like substance. The speed with which this chemical appears in the blood and the degree to which it accumulates there shows whether or not the patient has an overactive thyroid gland.

UPSETTING previous ideas of how the body uses iodine, a chemical known to be essential to health, Dr. Asher S. Chapman, of the Mayo Clinic, has discovered that the body can use this element even when the thyroid gland has been removed. Thyroxine, the powerful hormone produced by the thyroid gland, contains iodine and it has generally been thought that the effects of iodine on the body and the body's need for it were determined by this gland. Animals whose thyroid glands had been removed, Dr. Chapman found, lost more weight, utilized their food more poorly, drank more water and had a significantly lower basal metabolic rate when kept on diets very low in iodine than when given adequate amounts of iodine. The body, it appears, from these studies, not only can use iodine when there is no thyroid gland to turn it into thyroxine for stimulating various body processes, but even may make a compound like thyroxine in tissues other than the thyroid gland.

CASES of "sudden death without warning" in patients who have been given barbiturates to put them to sleep for surgical operations may be explained by studies reported by Dr. Henry K. Beecher and Dr. Carl A. Moyer, of the Harvard Medical School and the Massachusetts General Hospital. It was pointed out that the brain center that regulates breathing loses its sensitivity to the stimulus of carbon dioxide when the barbiturates have been given. This results in a dangerous piling up of carbon dioxide in the blood. Considered together with other effects of the barbiturates on the breathing system when the oxygen in the blood varies from normal, this finding presents serious possibilities. Prevention in future of fatal accidents under barbiturate anesthesia may be achieved with these findings as guides.

ONE of the newer plastics, vinyl resin in acetone, painted or sprayed on to a patient's skin before an operation, helps to keep germs out of the wound, according to Dr. Michael DeBakey and Dr. E. J. Giles, of the School of Medicine of Tulane University of Louisiana. Complete sterilization of the skin before the first cut is made, to avoid danger of wound infection, is the aim of every surgeon, but is difficult to achieve. Even with all the usual precautions, a resident flora of germs remain a "constant potential source of infection." Vinyl resin, familiar to most people as a waterproof coating for fabrics and for its use in safety glass in automobiles, when used as a skin covering before operations has the following advantages: Bacteria can not get through it; bacteria are killed by it; it is transparent; it sticks to the skin; it is elastic; it can be easily cut through, and it is not irritating.

DEATHS from acute appendicitis with perforation or rupture of the appendix have been reduced to less than five out of every 100 by the use of sulfathiazole in addition to immediate operation, was reported by Dr. Edward S. Stafford, of the Johns Hopkins University School of Medicine. Immediate operation when the appendix has ruptured reduced the deaths to 10 per cent. of all cases with perforation, which is lower than the average mortality reported from the so-called delayed treatment, Dr. Stafford found from an earlier study of patients operated on at the Johns Hopkins Hospital. During the two years since that study was reported, sulfathiazole has been used in addition to immediate operation. The death rate for this recent series is under 5 per cent.—less than half that of the earlier series.

PATIENTS with broken bones in which the skin and other tissues are also broken open and infected with germs, a common condition in war injuries and automobile accidents, may be saved by sulfanilamide crystals implanted in the wounds, according to Dr. N. Kenneth Jensen, of the University of Minnesota Medical School. In one hundred and twenty-six cases of such injuries, technically termed compound fractures, not a single case of gas gangrene and only four wound infections occurred



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when sulfanilamide crystals were placed directly in the wound. Without the sulfanilamide, but with the same treatment otherwise, gas gangrene developed in 7.3 per cent. of cases and other wound infections developed in 27 per cent.

WOUNDS heal poorly after an operation and are likely to break open when the patient has been getting too little vitamin C, the vitamin found in tomatoes, citrus fruits and other fruits and vegetables, was reported by Dr. John B. Hartzell and Dr. William E. Stone, of Wayne University College of Medicine. Healed wounds in guinea pigs that had been deprived of vitamin C had only one fifth the strength, that is, could withstand only one fifth the pull on them, as did wounds in laboratory animals that had been getting a normal amount of this vitamin.

A NEW supplementary instrument to help the surgeon look into the body and actually see an appendix or a bleeding stomach ulcer before he operates was announced by Dr. Joseph E. Hamilton, of the School of Medicine of the University of Louisville. The new instrument is a blunt-tipped rod or "poker" with an insulated electrode. It is used with the peritoneoscope, a periscope-like instrument which can be inserted through the abdominal wall to give the surgeon a view of the internal organs. The poker is used to maneuver the appendix, for example, into plain view if it is hidden behind a loop of intestines or adhesions. The accompanying electrode may be used to divide adhesions or to open benign cysts. New or little exploited applications of the peritoneoscope developed in examination of one hundred and twenty-five patients were reported by Dr. Hamilton.

DR. JOHN MARTIN, of Northwestern University Medical School, stated that when the dominant frontal lobe of the brain is removed, the remaining frontal lobe takes over new functions to such an extent that "a deficit in powers of association is frequently impossible to detect." In eight out of ten such operations the patients not only survived but were able to lead normal, useful lives, having returned, as Dr. Martin put it, "to a position of social and economic integrity." The operation was performed because of tumors of the frontal lobe. The frontal lobe, Dr. Martin said, is one of the few locations in the brain where such a radical operation as complete removal should be done, when feasible, to give the patient maximum benefit, although the operation is by no means a "benign procedure."

POSSIBLE danger from blood transfusions to patients whose lungs are partly out of commission from injury, disease or operation appeared in experiments reported by Dr. John H. Gibbon, Jr., of the University of Pennsylvania Medical School. Animals from which the right middle and all the lower lobes of the lungs had been removed could not survive a blood transfusion of the size well tolerated by normal animals.

SYNTHETIC anti-bleeding vitamin K acts so swiftly that within two hours after giving it patients previously in danger of fatal hemorrhage can be safely operated on,

was reported by Dr. Jonathan E. Rhoads, of the Medical School of the University of Pennsylvania. The vitamin stimulates production of prothrombin, the substance necessary for proper clotting of blood that is shed. In certain cases of jaundice, the amount of prothrombin is very low, but the patient needs an operation to relieve the condition. When vitamin K was first discovered, it had to be given by mouth. Effect on the blood-clotting mechanism was slower and sometimes it was impossible to give the vitamin because of persistent vomiting. Since then the synthetic forms of the vitamin which can be given by hypodermic injection have been developed. It is still not possible to prevent cholemic bleeding entirely, Dr. Rhoads said, but fatal hemorrhage has now become a rarity.

### SCIENCE CLUBS

SCIENCE SERVICE sends the following information concerning the Science Clubs which it has taken over from the American Institute:

*San German, P. R.*—"Explorers of the Unknown" is the name of a new science club at the San German High School. Sponsored by J. Nagario de Martin, chemistry teacher, this group puts realism in its projects by collecting money for the purchase of needed classroom material.

*Syracuse*—The Physical Science Club of Grant Junior High School, sponsored by D. H. Ackerman, held a Science Exhibit on November 4 and 5. The club uses an interesting study plan, with a different committee presenting a program at each meeting.

*Chestertown, Md.*—The Garnett High School Science Club, sponsored by Olin T. T. Thompson, is experimenting in the growth of plants without soil and is developing exhibits for a Science Fair.

*DeLand, Fla.*—Members of Kappa Pi Kappa, sponsored by Miss Alice Van Cleef, will hold a fingerprinting campaign for students of DeLand Senior High School. Members, now sporting the new Science Clubs of America pin, have worked out an extensive program that will include lectures, demonstrations, experiments and field trips to industrial organizations.

*Pittsburgh*—Members of the Biology Club of Peabody High School are making field collections for microscopic work and are building up their file of plants and leaves. Under the sponsorship of Miss Marie Knauz, the club has been able to arrange talks by members of the Audubon Society and the State Game Commission.

*Lawrence, Kans.*—Building airplanes, making radios and conducting experiments with dyes and bacterial cultures are in the program of the Junior Academy of Science Club at Lawrence Junior High School. Under the sponsorship of Miss Edith Beach, members are working up an exhibit for the yearly state meeting. The club has been in existence since 1930 and is affiliated with the Kansas Junior Academy of Science.

*Wellsville, Mo.*—Demonstrations in physics, biology and chemistry are being made by members of the Bi-Phy-Chem Club of Wellsville High School, sponsored by Miss Gertha Stark. The club is affiliated with the Missouri Academy of Science.

*Scotch Plains, N. J.*—The Science Research Club of

Scotch Plains High School, sponsored by H. S. Gutknecht, head of the Science Department, prepared a radio script dramatizing the work of Sir Frederick Banting, recently killed in an air crash. The story of the famous scientist's discovery and isolation of insulin was impressively delivered over the school's public address system.

*Hurlock, Md.*—The ? Or Why Club, sponsored by Miss Helen Warren, has divided into three groups, one making a model airplane, another working with the microscope and the third developing individual scientific projects.

*New York City*—The Biology Squad of the DeWitt Clinton High School, under the direction of Miss Dorothy P. Tuthill, is working out advanced research problems in slide-making, hydroponics, genetics experiments with fruit flies, guinea pigs, tropical fish and the preparation of museum mounts such as stained bone and tanned skins.

*Oneonta, N. Y.*—The Chem Squad of Oneonta Senior High School, sponsored by Mrs. Madeleine Frink Coutant, who is also director of the Oneonta Science Center, is holding monthly movie shows on scientific topics not taught in high schools. In February the Squad will visit a science club in Walton, N. Y., and early in May will feature a Science Congress.

*Brooklyn, N. Y.*—Members of the A. L. Chemists of Abraham Lincoln High School are developing Science Congress demonstrations in Science Fair exhibits under the sponsorship of N. Roseman. Laboratory demonstrations and experiments are a regular feature of the club's program.

*Harrison, N. Y.*—Chemistry, biology, physics and astronomy are major interests of the Kohut School Science Club, sponsored by Albert J. Metlicka. The club also works on photography and makes many field trips for nature study.

*Bronx, N. Y.*—Members of the Morris High School Photography Club, sponsored by Miss Gisella Kauf, teach developing, printing and enlarging to interested students who have not had much experience in this field. Various club members give lectures and demonstrations and produce photographs used in the school newspapers.

*Delmar, N. Y.*—The Eighth Grade Science Club at Bethlehem Central School, sponsored by Philip B. Moore, is holding classroom demonstrations, assembly programs, laboratory experiments, field trips and scientific movies.

## WILDLIFE CONSERVATION AND MANAGEMENT

DESPITE progress made in recent years in the field of wildlife conservation and management, many improvements are still needed in most of the state programs, and no state is entitled to feel that it has approached an ideal wildlife administration, E. Sydney Stephens, chairman of the Missouri Conservation Commission, pointed out in an address before the International Association of Game, Fish and Conservation Commissioners.

In making a survey of wildlife administration in this country, Mr. Stephens circulated a questionnaire among the authorities of all forty-eight states, and obtained forty-three responses. His analysis of these disclosed weaknesses ranging from appointive and regulative set-

ups that permit undue political influence and insecurity of tenure in office, to sad neglect of field research, educational programs and securing of the cooperation of landowners on which future progress in wildlife restoration and administration must depend.

Less than four per cent. of 7,820 conservation employees in forty-three states have technical training to qualify them for their jobs, the speaker said. Nine states have no technically trained employees whatever, and twenty-one states have no provision for scientific research on the problems their game commissions are supposed to solve. Fifteen states carry on no educational programs, and twenty-three states address their educational efforts to adults only, neglecting the schools entirely.

## ITEMS

THAT a decline in pneumonia deaths during an influenza epidemic occurred, for the first time on record, during the winter of 1940-1941, is announced by statisticians of the Metropolitan Life Insurance Company. A minimum figure for pneumonia deaths below which a further considerable reduction is unlikely is being approached, is indicated by these studies. Fatal pneumonia cases are now concentrated in young children and comparatively old people. Many of the deaths, about one fourth in the opinion of attending physicians, were due to complicating diseases. Sulfa drug treatment seems to have largely replaced serum treatment. Sulfathiazole was the favorite drug last winter, but sulfadiazine is likely now to be used far more widely. Bacteriological studies to determine the germ responsible for the pneumonia in each case seem to have been largely abandoned in urban centers.

A NEW method of treating cancer of the mouth, pharynx and larynx which appears to be more effective than similar methods now in use is reported by Dr. Max Cutler, of the Chicago Tumor Institute, in the *Journal of the American Medical Association*. The new method is called the "concentration method of radiotherapy." It has been given to some 850 patients at the Chicago Tumor Institute and the Hines Veterans Hospital during the last three and one half years. Certain carcinomas of the mouth, larynx and pharynx which failed to respond to other methods of external irradiation have shown marked regression and in many instances have disappeared completely following treatment with the new method. It is, however, still too soon to know whether or not permanent cures have been achieved. The method consists in giving higher daily doses of x-rays or radium over a shorter total period of treatment than has been customary.

GERMAN authorities, in their anxious search for ways to release able-bodied men for the firing line, have found means for employing blind men to do accurate measuring work on small machine parts and the like. In the Junkers factory, according to *Die Umschau*, devices have been constructed that will announce differences of as little as one twenty-five-thousandths of an inch by means of bell or buzzer signals. These replace gauge dials of the instruments hitherto used.



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## SCIENCE NEWS

Science Service, Washington, D. C.

## THE DISTANCE OF THE SUN FROM THE EARTH

ASTRONOMERS were considerably shocked to find, according to their most recent measurements, that the sun is more than 100,000 miles farther from the earth than was previously supposed. These measurements now give its mean distance as 93,003,000 miles in place of the formerly accepted 92,870,000 miles.

The layman is not likely to get unduly excited over this correction to the figure that has never meant much to him, but to the astronomer it is of the utmost importance. The sun's mean distance is the astronomer's yardstick by which he measures everything else in the universe. He calls it the astronomical unit and writes it AU. Any change in this unit means that every other dimension in the universe has to be changed.

On this unit depend our figures for the masses of the earth, sun and moon, and on these depend in turn the accuracy of tide predictions and of navigations. Because of its importance, astronomers have been measuring and remeasuring it from the time when the Greek astronomer Aristarchus made the first attempt two and a half centuries before the birth of Christ down to the present time, always striving for greater and greater accuracy.

Evidence of the care and labor expended on this task is the fact that the present figure was arrived at after ten years of calculations. They were based on thousands of observations made on the asteroid Eros on its last close approach to the earth in 1931, when it came to within 16,200,000 miles of us. The calculations were made by Dr. H. Spencer Jones, astronomer royal of England, and were announced at the June and July meetings of the Royal Astronomical Society. They have now been reported in the first issue of the new magazine, *Sky and Telescope*, issued from Harvard College Observatory. The long time consumed in the calculations was due to the fact that the material was gathered from all over the world, and much of it was late in coming in.

But, after all the trouble and labor, the new figure is not yet definitely accepted by astronomers. The calculations so far have been purely geometric—they have involved only angles, lengths and positions. The same data can be used to determine the gravitational attractions or perturbations of the sun and earth on Eros during the time of its close approach. These give new measures of the masses of the sun and earth from which the distance can be determined. This gravitational method is considered even more accurate than the purely geometrical one. Its results must be awaited before astronomers can make a final decision as to the value of the unit.

## DAILY VARIATIONS IN THE HEAT OF THE SUN

THE floor of the stratosphere, tropopause, may shift up and down from day to day, in response to daily variations in the sun's heat. This in turn may have far-reaching effects on world weather. Indications that these

fluctuations are influenced by solar radiation changes have been brought out in researches of Dr. Henryk Arctowski, the Polish meteorologist who is now working at the Smithsonian Institution.

The occurrence of daily fluctuations in the sun's heat was established as a fact long ago, by Dr. Charles G. Abbot, secretary of the Smithsonian Institution. The scope of these variations is frequently as much as half of one per cent., and occasionally much more than that. These variations occur in a complex series of cycles.

If the earth were without an atmosphere, like the moon, changes in solar heat would be felt immediately at the earth's surface. But the sun's heat has to pass through a hundred-mile blanket of air to reach the ground, so that its effects are delayed and complex. Winds, clouds and other factors all have far-reaching effects in the distribution of radiations coming to us from the sun.

At some place, however, it is necessary to look for direct effects of solar radiation. According to Dr. Arctowski, the most probable place is the tropopause—the level where temperature decrease with altitude comes to an end. His researches indicate that solar radiation variations cause changes in the height of this surface over the tropics, where it normally is about 12 miles high, and that these changes proceed northward and southward in wave-like motion.

An up-and-down movement of the tropopause, in turn, causes a variation in the height of the highest clouds and in the movements of air masses. These in turn produce different rainfall effects in various parts of the earth.

## METEOROLOGISTS AND NATIONAL DEFENSE

METEOROLOGISTS watch the skies now-a-days with first thought for national defense. They have postponed "for duration" many important research projects and are devoting themselves to the training of field observers for the Army and Navy, and to the instruction in such parts of their science as will enable aviators to fly better. These and other contributions of meteorologists were pointed out by Professor Charles F. Brooks, head of Blue Hill Meteorological Observatory of Harvard University, at a symposium on Science and Defense by the American Association of Scientific Workers. Dr. Brooks estimated that perhaps a quarter to a half the time of meteorologists in the United States is now being devoted to defense activities. There are those in the armed forces and civilian instructors in the numerous schools for airplane pilots and navigators who are devoting all their time to the defense effort. There are those in the five universities and technical schools who are devoting practically all their time to training hundreds of cadet officers to become weather forecasters. There are probably 50 or 100 meteorologists among the instructors in the C.A.A. courses at 1,000 institutions of higher learning throughout the country. The U. S. Weather Bureau is working on many projects at the behest of the Army or Navy, and its general forecasting

service is used directly or indirectly by the people of the United States, including defense workers, while special forecasting in connection with particular defense needs is much in demand. There are, indeed, few meteorologists whose time is not being devoted in part to defense.

Deflection of research effort to problems of immediate defense significance is felt most acutely in the fields of pure research. Professor Brooks pointed out that it is exactly this kind of research that in the end pays the biggest, though often the least foreseen, dividends. This handicap is partly offset, however, by the intensification of research in certain other applied lines, and in the increase in facilities which are being made available because the defense program calls for their use. Results thus obtained will not be confined to defense, nor will the benefits gained be discontinued with the cessation of the national emergency.

### DEATHS FROM TUBERCULOSIS

DEATHS from tuberculosis have decreased more swiftly among industrial groups than among the general population, was reported by Dr. L. U. Gardner, director, the Saranac Laboratory, at the opening session of the sixth annual meeting of the Industrial Hygiene Foundation of America.

Dr. Gardner's statement was based on careful studies by 30 observers in different industrial environments. It was made to refute "a growing tendency to account for a freshly discovered case of tuberculosis as a product of industrial environment."

"A low standard of living, rather than specific environmental factors, is responsible for most of the tuberculosis among wage earners," Dr. Gardner said. "For example, the influence of nutrition, fatigue, extremes of temperature and humidity and specific intoxications such as lead, were discussed and it was agreed that only nutrition had an appreciable effect upon tuberculosis incidence among workers."

Dr. Gardner found that of the respiratory irritants, including fumes and gases, as well as dusts, only free silica has a specific influence upon the disease. To illustrate the negative tubercular effects of a pulmonary irritant, Dr. Gardner cited an experiment in which guinea pigs with super-imposed tuberculosis were exposed to arc welding fumes.

A control group of tubercular animals was not exposed. It was discovered that in spite of severe inflammatory reaction in the lungs due to the welding fumes, the exposed animals recovered from tuberculosis as well as the non-exposed controls.

Another group of guinea pigs—200 were used in all—was infected with the same type of tuberculosis, and at subsequent intervals of four, six and eight months, exposed to the fumes. The preformed healing tubercles in the lungs were not reactivated by the fumes as was the case when the animals were exposed to quartz dust.

### TOOTH DECAY AND PYORRHEA

TOOTH decay, one of the commonest of dental diseases, may be due to a deficiency of some of the vitamins in the B group, it appears from laboratory experiments reported

by Dr. Hermann Becks, professor of dental medicine at the Hooper Foundation for Medical Research, University of California, and Dr. Agnes Fay Morgan, professor of home economics at the university.

Dogs on a diet lacking one of the B vitamins developed tooth decay, normally absent in dogs. The B vitamin lacking was the filtrate factor. Its function is still a mystery. When the dogs' diet was deficient in nicotinic acid, the animals developed pyorrhea and severe bleeding of the gums. A third, or control group, on a balanced diet, developed no decay or pyorrhea.

Dr. Becks makes no attempt to fit his findings to human tooth decay since he worked only with dogs. "On the other hand," he points out, "clinical experience has already produced excellent results with certain vitamin B fractions in the treatment of Vincent's disease, an infection of the mucous membrane, and other inflammatory diseases of the mouth. Ulcer formations of the tongue and inside the cheek have been successfully treated by the administration of nicotinic acid."

Dr. Becks said that the experiments provide a most encouraging link between carbohydrates and dental decay. The body converts carbohydrates into sugars. It is well known that vitamin B is necessary for the correct assimilation of sugars. However, a large percentage of the foods of the modern diet have the vitamin B removed in processing. This leaves the body, including the teeth, without protection against the harmful effects of sugars which do not contain vitamin B.

Dr. Becks and other research dentists have shown that there is a direct relationship between tooth decay and a bacillus, called *Lactobacillus acidophilus*. The number of bacilli found in the mouth has been found to be in direct proportion to the amount of sugars and carbohydrates consumed, that is, sugars and carbohydrates which have the vitamin B removed in processing.

Dental decay, like the common cold, is one of the mysteries of medicine. The American Dental Association has provided a fellowship for dental research at the National Institute of Health, the U. S. Public Health Service, to help to solve this problem.

### THE MOLD PENICILLIUM

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For most human beings the age of cannibalism is over. But not so with microbes. One eats another with the careless abandon of a vegetarian tucking into his beans. This cannibalism amongst microbes has led to a discovery by British investigators of profound importance to doctors and patients the world over. The story is found in recent issues of two British medical journals. It opened some years ago in the department of bacteriology of one of London's largest teaching hospitals, St. Mary's.

Professor A. Fleming was engaged in his daily routine work in his bacteriology laboratory. He was growing colonies of different germs on specially prepared plates. One of his plates he noticed was contaminated by a mold, not unlike the molds that grow on stale bread or cheese or sausages. This too is a common occurrence in a laboratory, for one of the most difficult tasks is to grow germs pure and uncontaminated.

Most of us would have removed the mold and started again, but Professor Fleming went one better. He allowed the mold and germ to remain on the plate, only to find that while the mold was there the germ would not grow. In fact the mold killed the germ. This was the first, indeed the fundamental, discovery—if the microbe did not eat its fellow microbe it certainly killed it.

The professor pursued the matter further. He discovered that it was only some germs which found it impossible to live side by side with the mold. So whenever he wanted to get rid of one of the germs he knew the mold could not live with, he added some mold to his plates. He exploited their known unneighborliness.

So far the discovery was interesting, but not of great importance. Then came the suggestion that this mold, *Penicillium*, might be used to kill germs which were actually in the human body. Could not the germ-killing substance which *Penicillium* contains be used as an antiseptic to kill germs inside the human body?

Professor Florey, of the University of Oxford, headed a team of workers to tackle this problem. After many experiments they succeeded in extracting from the mold the substance in it which possesses the antiseptic quality. From the mold *Penicillium* they extracted the germ-killing substance penicillin. This done, further experiments soon showed that penicillin was the most powerful germ-killer both inside and outside the body, superior even to the latest drugs. That is saying a great deal, for in recent years medical science has made enormous strides in antiseptic drugs.

Prontosil, sulfanilamide, M & B 693, sulfathiazol—already these new drugs all in the same big family have saved thousands of lives. In pneumonia, meningitis and in severe infections of many kinds they have been found to be immensely useful. But penicillin goes one better—it is both the strongest and the safest germ-killer yet discovered. It does its work even when diluted to the astonishing extent of one in a million. It can be given by mouth or injected directly into a vein. Most important of all, it kills the germ inside the body without harming the body itself. Its work of germ-killing done, it passes through the body into the urine, from which it can be extracted by the chemist and used again.

There is one snag. Although there are plenty of molds in this world, there is not enough *Penicillium* mold of the right kind to give us large quantities of penicillin. That difficulty may not prove insuperable. Research is now being undertaken to discover other sources of penicillin. Its chemical composition is being investigated in the hope that chemists may be able to manufacture it artificially in the laboratory.

We do well to remember that the value of lemon juice in preventing scurvy was known before vitamins were ever heard of. But when it was found that lemon juice prevented scurvy because it contained vitamin C, the chemists got busy and made the vitamin artificially in their laboratories. Let us hope that the story of penicillin is the story of vitamin C. Hopes are very high. *The British Medical Journal*, known for its cautious attitude, has gone so far as to say that penicillin is to other anti-

septics what radium is to other metals. In view of that praise it is not too much to say that St. Mary's Hospital, London, and the University of Oxford have made a most important contribution to human knowledge.—CHARLES HILL, *Deputy Secretary, British Medical Association*.

## ITEMS

THE earthquake that damaged Los Angeles suburbs early on the morning of November 14 had its epicenter directly under the damaged areas, or at least very near them, in the opinion of seismologists of the U. S. Coast and Geodetic Survey. They also believe that its intrinsic force was not very great. This opinion is based on the rather local distribution of the damage. Had the earthquake been a really violent one, with its epicenter at some distance, the damage would have been more wide-spread. It seems to have been similar to one that occurred in the same general region on the night of October 21-22. It was a double shock, with a maximum force of 7, on the seismologists' scale of 10. The epicenter of this earthquake was at Keystone, near Wilmington, Calif. The U. S. Coast and Geodetic Survey has a number of special pieces of apparatus, known as strong-motion instruments, which are distributed at Los Angeles, Hollywood, Pasadena, Long Beach and other points in the Southern California region. These are so set that they begin to record earth motion only after an earthquake actually begins.

THE Federal Bureau of Investigation reports that it has deciphered the contents of a 100-year-old American history document sealed in a bottle and buried. Several of these bottled documents have been unearthed recently by the Louisiana Geodetic Survey from mounds along the Louisiana-Texas boundary. In all but one bottle the parchment had deteriorated. When the preserved parchment was sent to the FBI technical laboratory, experts first photographed the bottle from different angles, to obtain as much of the writing inside as possible. Then they removed the sealing wax and extracted the old parchment and photographed it immediately. It reads: "To mark the Meridian Boundary Between the United States of America and the Republic of Texas, this Mound is erected on this the 26th day of April 1841, six miles North of the 32nd degree of North Latitude." Names of officers of both republics who took part in the bottle-burying ceremonies along the border were inscribed below.

A "LOST HORIZON" constituting the boundary between the Age of Dinosaurs and the Age of Mammals has been found by paleontologists of the U. S. Geological Survey and the Smithsonian Institution in the Colorado mountains near Denver. The sequence from extinct reptiles to ancient mammals has been studied by Dr. R. W. Brown and Dr. C. Lewis Gazin, of the U. S. National Museum. The site is a mesa topped with a layer of basalt. About 200 feet down from this protecting cap of hard rock is a layer containing fossils of paleocene mammals, primitive flesh-eating creatures that roamed the earth about fifty million years ago. Below this is a layer of about fifty feet of barren rock, containing no fossils, and immediately below that is a stratum containing the dinosaur bones.

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## SCIENCE NEWS

*Science Service, Washington, D. C.*HAVANA CONFERENCE OF COMMITTEES  
ON INTELLECTUAL COOPERATIONS  
FROM AMERICAN COUNTRIES

NATIONAL Committees on Intellectual Cooperation from nineteen American countries met recently in Havana.

A tri-lingual hemisphere is envisaged by Dr. Antonio S. de Bustamante, who opened the conference and stated that understanding of one another's languages was the first essential of friendship and unity between our nations. He asserted that Spanish and Portuguese should become "second languages" of the United States, as English is fast becoming the second tongue of Central and South American states. When we can freely converse, we can cast off our suspicions of one another, read the literature of other Americans and develop a family spirit.

Dr. James T. Shotwell, head of the delegation from the United States, stated that the preservation of freedom throughout the world was the ultimate objective of the conference. He said it was impossible for cooperation and unity to be imposed upon peoples; that it must spring from a genuine appreciation of the achievements of one another. "The peace settlement of the present war must include strong measures for cultural cooperation among nations," he concluded.

The development of science and scientific societies among the American republics was brought up in a resolution presented by the delegates from Peru. The proposal is for a series of international literary and scientific competitive contests, with money to be contributed by their respective governments. Prizes of \$8,000 and \$2,000 would be awarded each year for outstanding literary and scientific works.

In addition, proposals were drafted by the conference calling for wide-spread exchange of students, teachers and scientific leaders among the American republics during the coming years. Selection of these would be on the basis of scholarship merit, character, ability to profit by the experience, and familiarity with the language of the country. Resolutions were offered condemning the treatment of many scholars and scientists in occupied countries of the world, and asking that the governments of the American nations offer every possible facility to exiled scientists and scholars, and give them freedom of movement among the several American states. This conference marks a milestone in inter-American relations, and proposes to set up means of free exchange of various scientific and cultural works, educational films and works of art and music. Changes in copyright laws, to give better protection to writers, were recommended.

The delegates from the United States included the following: Dr. James T. Shotwell, *chairman*; Dr. I. L. Kandel, Virginia Gildersleeve, Mrs. Laura D. Barney, Malcolm Davis, Stephen P. Duggan, Sterling Fisher and Dr. George Zook. Observers for the United States are John Lockwood, Charles Thomson and Dr. J. H. Furbay, director of the Casa Pan-Americano at Mills College, Calif.—J. H. FURBAY.

THE UNITED STATES ANTARCTIC  
EXPEDITION

THE first reports on scientific results of the U. S. Antarctic Expedition were presented at the opening session of the autumn meeting of the American Philosophical Society, Philadelphia. Those who withstood the siege of the world's worst blizzards on the world's most desolate land have spent the time since their return in digesting the data that they gathered, and are now beginning to publish their findings. Professor F. Alton Wade, of the U. S. Antarctic Service, outlined reports now ready, and those still in preparation, on studies of the aurora, ice formations, geology, ornithology and weather and radio conditions.

How a sledging party climbed the mile-high Antarctic plateau with a ton and a half of equipment pulled by four dog teams, and set up the world's southernmost weather observatory, was told by H. G. Dorsey, Jr., of the U. S. Weather Bureau. Two of his colleagues, Lester Lherke and Robert Palmer, occupied this outpost of science for two months.

"Despite prevailing northeasterly storms of drifting snow," Mr. Dorsey said, "their days were well spent between living quarters in a sturdy tent and meteorological office in a snow cave. For the first time in South Polar regions, detailed high level weather data were obtained in a form suitable for comparison with near-by sea-level observations."

They remained in constant touch with the main party at East Base by radio. Every six hours, simultaneous weather observations were made at both stations. At the same time, automatic instruments were making continuous autographic records of wind, pressure and temperature. Pilot balloon observations of the winds aloft were especially valuable when there was a low overcast below the plateau. The data they obtained proved highly valuable in forecasting flying conditions for the expedition's planes.

Cosmic ray results, obtained by instruments on shore, on shipboard and carried aloft by both airplanes and radiosonde balloons, were reported by Professor Serge A. Korff, of New York University.

New details, added to the map of Antarctica by five field parties working on the ground and two airplanes operating from West Base, were reported by Paul A. Siple, geographer of the U. S. Antarctic Service. Four newly discovered areas of internal disturbance were studied, and 15 bays and inlets were photographed in the continuous aerial survey of about 400 miles of barrier ice, from an altitude of 7,000 feet. Inland, gaps in previously existing maps of Antarctic mountain chains were filled, and absence of sea-level connections between the Ross and Wedell seas was confirmed.—FRANK THONE.

## A NEW VACCINE AGAINST INFLUENZA

A NEW, powerful vaccine against influenza and pictures showing for the first time what the influenza virus

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looks like were presented by Dr. Leslie Chambers and Dr. Werner Henle, of the Johnson Foundation of the University of Pennsylvania, at Philadelphia, before the society.

The first human trials of the vaccine, on several hundred volunteers, are scheduled to start next week. It is so powerful that a single shot quite regularly protects mice against 100,000 killing doses of influenza virus.

The virus of influenza itself, now seen for the first time with the aid of the electron microscope, was revealed as an unimaginably tiny spherical particle with a diameter of 11 millimicrons. This is so small that, placed side by side, enough of these particles to give influenza to about 500 mice could be covered by the period at the end of this sentence. This is based on the calculation that the minimal infectious dose is less than 100 particles. The influenza A virus particle is one of the smallest disease-causing substances yet isolated. It had previously been believed to be about nine times this size. The larger particles which had been found in lungs of mice infected with influenza A are now believed to be components of normal cells which acted as carriers of the much smaller influenza virus particles.

True influenza virus particles were isolated from extra-embryonic fluids of developing hens' eggs that had been infected with influenza. Chemical analysis showed the virus to be composed largely, if not entirely, of the kind of protein found in the nucleus of cells.

The virus was concentrated from the extra-embryonic fluids by spinning it for 90 minutes in an ultra-centrifuge with a force 90,000 times that of gravity, and by the addition of protamine, familiar to diabetics from slow-action protamine insulin. The new vaccine, besides being remarkably effective in mice, has the advantage of being free from foreign proteins which might produce unfortunate reactions. It will be some time before its protective value is known. Tested on mice, it showed greater efficiency than the vaccine developed at the Rockefeller Institute which, in trials during last winter's epidemic, cut down influenza among vaccinated persons to 50 per cent. of that among unvaccinated persons in the same institutions.

### LIMESTONE FORMATIONS IN THE LUNGS AND TUBERCULOSIS

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A COMMON but not yet recognized disease has been shown by investigators of the U. S. Public Health Service to be the cause of tiny limestone formations in the lungs previously thought due to tuberculosis. Because physicians have taken these tiny spots shown up on x-ray plates to be due to tuberculosis lesions that have been cured, the new findings will probably cause a change in medical diagnosis of many cases. Curiously, the new disease is highest in areas where there are extensive limestone and chert formations, that is, in areas adjacent to the Appalachian Plateau.

These observations aroused the Public Health Service to make an independent study. It selected Ross County, Ohio, an area adjacent to the Plateau, where lung calci-

fication is common, but tuberculosis fatalities not above ordinary. Rural families were selected in order to rule out as far as possible contacts with tuberculosis outside the household. More than 200 persons in 44 farm households were x-rayed and tuberculin tested. Of 253 persons effectively x-rayed, 125 showed the limestone formation in the lungs—but none had significant tuberculous lesions. Of 235 who were tuberculin tested, 194 were negative. Fifty-six persons with negative tuberculin tests showed lung calcification. The studies were made by Dr. B. J. Olson, passed assistant surgeon; Dr. W. H. Wright, chief of the division of zoology, and M. O. Nolan, associate zoologist, all of the Public Health Service.

The existence of an unrecognized disease of very common occurrence is suggested by these investigators. It appears to produce the lung lesions closely resembling the x-ray picture of primary tuberculosis. They believe therefore, that the finding of lung calcification particularly in tuberculin-negative persons should not be assumed to be evidence of tuberculosis infection.

With tuberculosis apparently ruled out, the ascaris as a possible cause of the lung calcifications was next considered. Ascaris is a tiny, parasitic worm, which in the larval stage may damage the human lung. Careful study, however, failed to prove or disprove that ascaris was guilty. The studies are being continued.

### MENTAL BREAKDOWNS

STRICT physical and mental examination before induction will enable the United States to avoid mental and nervous breakdowns among its armed forces, according to Dr. Robert Dick Gillespie, psychiatric specialist of the Royal Air Force of Great Britain, who gave the first of the Salmon Lectures at the New York Academy of Medicine.

Dr. Gillespie said that there are remarkably few cases of psychoneuroses because of the extreme care used in selecting members of the Royal Air Force. Only the mentally and emotionally stable get past the weeding-out process. Every one who flies for the RAF and most of the ground force has the "professional attitude" toward his work, whether he is a pilot or an air gunner, a mechanic or a rigger. His patriotic devotion is reinforced by his pride in his particular technique and his devotion to his job.

Dr. Gillespie credited the "greater importance which is attached to the individual" in this war as one reason why there are fewer neurotics than in the last war. Even among the infantry a man tends "to be more and more a technician, and less of a foot flogger." He told of a hospital specially built for the care of psychoneurotic victims in the RAF that had to be closed after a few months and directed to other work because there were not enough patients to fill it.

Surprisingly enough, Dr. Gillespie continued, the war has given birth to two institutions, shelter life and community centers, which are highly successful as a preventive of psychoneuroses. "We have learned that shelter life with its common sharing of danger has helped people to withstand peril better than isolation in small groups,

which often contributes to the development of psychoneuroses. The feeling of being with others during an air raid, even in an insecure shelter, brings courage. Shelter life and community centers fill a need for companionship. In large cities, before the war, we had the paradox of want amid plenty, social want in the midst of social possibilities. Now persons return from safe areas to the shelters in large cities declaring, 'I'd rather be bombed than bored.'

"Activity of some sort is a necessary condition of happiness," he said, "and for many people a necessary preventive of psychoneurotic or anti-social behavior. It is important for psychiatrists to recognize the apathy or restlessness which may precede psychoneurosis."

### HAY-FEVER

New evidence that a chemical released by the blood cells may be partially responsible for some of the strange symptoms of hay-fever and other allergies, is reported in the *Journal of the American Medical Association*. Histamine is a chemical which stimulates the automatic nervous system over which we have no voluntary control. When histamine is injected into the skin, it produces the familiar "wheal" suffered by some allergy patients. It has long been suspected that this chemical may in part be responsible for many of the clinical symptoms of allergy. Experiments with animals supported this suspicion, and encouraged Drs. Gerhard Katz and Stanley Cohen, of Tulane University, to test blood taken from allergy patients and non-allergic persons.

When extracts of ragweed, house-dust or timothy were incubated with blood of non-allergic persons, no histamine production was noted. When, however, the blood of a person sensitive to one of the irritants was similarly tested, the histamine level rose considerably. Further, the reaction was specific. That is, if the patient were allergic to ragweed, but not timothy, his blood produced histamine only in the presence of the ragweed extract, not timothy. The authors conclude: "We may assume that at least at points of high concentrations of allergens (irritants), such as the tissues of the respiratory or digestive tracts, the histamine released from blood cells circulating through these areas should, to a certain extent, contribute to some of the local tissue reactions."

### "FREEZING" WASTE GASES FROM THE STEEL AND PETROLEUM INDUSTRIES

HIGH octane gasoline and synthetic rubber can be produced from waste gases of the steel and petroleum industries by application of a low temperature technic secretly developed in Russia, was reported by Professor Cecil T. Lane, of Yale University, in an address before the Society of Sigma Xi.

These gases are mixtures of valuable industrial gases. Each has a different liquefaction and freezing point, so that by lowering the temperature far below the freezing point of water, the different gases may one by one be frozen out and separated into pure components. Then they can be put together again in the various ways and proportions necessary to produce gasoline, rubber and

other vital defense materials, for which they provide an almost inexhaustible source of raw materials.

The surprisingly strong resistance of the Russians to the German invasion, Dr. Lane attributed in large part to their development of the low temperature industry, in which they were far ahead of Germany. In this country the industry is only in its infancy, but Dr. Lane foresaw that it would open up many new avenues in synthetic manufacturing.

Dr. Lane demonstrated the Peter L. Kapitza machine for producing liquid helium at a temperature 455 degrees Fahrenheit below zero. It is the only machine of its kind in the Western Hemisphere and there are only five other places in the world where liquid helium can be produced. The machine was built from a sketch sent from England before the outbreak of the present war.

### ITEMS

UNDER the direction of Dr. William J. Kerr, professor of medicine, a group of ten physicians will study the common cold and other respiratory infections of bacteria and viruses (ultra-microscopic disease agents), and the head, throat and chest maladies caused by allergies. The body's defenses against colds, including the efficiency of the human nose as an air-conditioner, will be analyzed. Some believe that a nose subjected to violent changes from warm to cold air sometimes fails to rally from such shocks sufficiently to carry on its air-conditioning service, and that a cold results. The relation between overcooling, atmospheric conditions and sudden temperature changes to cold-catching will be studied in a specially built room, large enough to accommodate six people, in which temperature and humidity can be changed rapidly to any desired condition.

UTILIZING a technique never before employed in metallurgy, a new process for the manufacture of aluminum from clay instead of the mineral bauxite, of which only about three years' supply remains in this country at the present rate of defense consumption, was announced to the American Institute of Chemical Engineers, by Professor Arthur W. Hixson, of the department of chemical engineering of Columbia University. The new process is expected to make this country independent of imports of foreign bauxite. It was developed at Columbia under the direction of Professor Hixson, assisted by Ralph Miller and Ivan J. Klein. All processes for the production of aluminum use only high-grade bauxite ores. About 3,143,000 long tons will be required annually for the defense program alone. The reserve in the United States at the present time is about 11,000,000 long tons, according to geological estimates. Half of this has been imported. Without a method of using some other ore than bauxite, the United States would soon have to import all its aluminum ore. The new process uses selected high-silica clays, digests the clay with hydrochloric acid and decomposes the resulting product to get aluminum oxide. From this, the metallic aluminum is extracted by electrolysis in the usual manner. The hydrochloric acid is recovered for further use. The materials and chemicals used are abundantly available because they are by-products of other processes.

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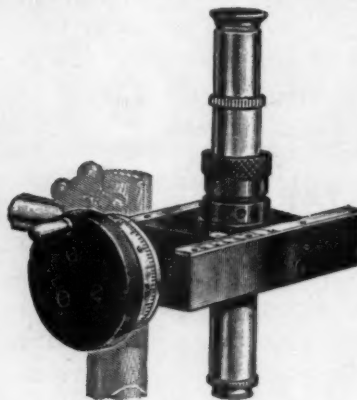
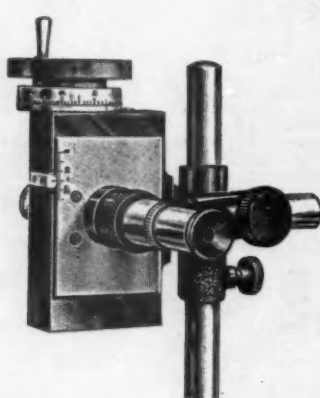
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## SCIENCE NEWS

Science Service, Washington, D. C.

## THE HAVANA CONFERENCE ON INTELLECTUAL AND CULTURAL COOPERATION

TRANSFER of the scientific and cultural societies of the world to the Western Hemisphere was forecast by the second Pan-American Congress on Intellectual and Cultural Cooperation meeting in Havana during the past week. The congress, representing nineteen American Republics, voted to invite to the New World the International Scientific Union, with headquarters in London, the International Union of Academies, formerly located in Brussels, the International Committee of Historical Sciences, the International Library Association and all other world cultural associations now suffering from the hindrances of war. Such large-scale transfer of scientific and historical associations would make this continent the world's center of learning. It would make the Western Hemisphere the coordinating center for all scholars and educators.

The congress voted to offer locations for these societies in various American Republics. With the decline of scientific research in Europe, it was felt, obligation and opportunity come to the New World to take over this function.

Also voted by the Congress of Government Representatives was a motion to recommend special passports and travel credentials for teachers, scientists and newspapermen, as these persons are especially qualified to spread mutual understanding and to create good-will among the nations of the Americas. Newspapermen were referred to as "professors of the popular masses" and "directors of public opinion." Special passports, and reductions in travel fares, would make possible a wider exchange of these men among our American republics and speed the day when we shall work and plan together for the Western Hemisphere.

Free entrance for all books and printed publications from country to country was urged in order to further mutual understanding by reducing costs. A commission was set up to compile a list of the most important books in each American Republic, and it is planned that these shall be published, one by each country, under the title, "Literary Masterpieces of the Americas." They would be printed in their original language, and also in translation. This would make it possible for a Pan-American literature to be developed.

Bureaus for disseminating medical information were also recommended, so that hygiene and public health discoveries of one country would be available to the others. An All-America Radio Office has already been established in Havana as a clearing center for all long- and short-wave programs between the Americas.

Because the question of copyright on printed materials has caused confusion in the past, a special committee was set up to work out a plan for better protection of literary works, songs and other works when circulated from country to country. It was lamented that piracy of these works had been known in the past and had hindered cooperation and confidence.—J. H. FURBAY.

## A POSSIBLE CURE FOR LIVER CIRRHOSIS

CHEESE and a vitamin may be the future cure for cirrhosis of the liver, fatal condition once known as "drunkard's liver."

Success in both treating and preventing the condition with a B vitamin and casein, chief protein of milk and cheese, is announced by Dr. J. V. Lowry, Dr. Floyd S. Daft, Dr. W. H. Sebrell, Dr. L. L. Ashburn and Dr. R. D. Lillie, of the U. S. Public Health Service.

Laboratory rats were the patients in this work, but the report comes hard on the heels of a report from two New York physicians that human liver cirrhosis patients were successfully treated by "a highly nutritious diet supplemented with vitamin B concentrates."

Taken together, the reports suggest that the day is fast approaching when a diagnosis of cirrhosis of the liver will no longer be equivalent to a death warrant, especially since the New York patients were given a diet which seems to have included the two substances that helped the rats.

Choline and casein are the two diet constituents successfully used by the investigators of the Public Health Service to treat and prevent liver cirrhosis in their rats. They had previously discovered that they could produce the condition by keeping the rats on a diet lacking in these substances, whether or not they got alcohol with the diet. Choline is believed to be one of the B vitamins. It is always found with these vitamins in foods and is in most vitamin B concentrates.

Dr. Arthur J. Patek, Jr., and Dr. Joseph Post started their diet treatment of human liver cirrhosis patients in 1939, more than two years before this report. They based the treatment on their observation that, in addition to signs of liver failure, the patients were malnourished and particularly lacked the B vitamins.

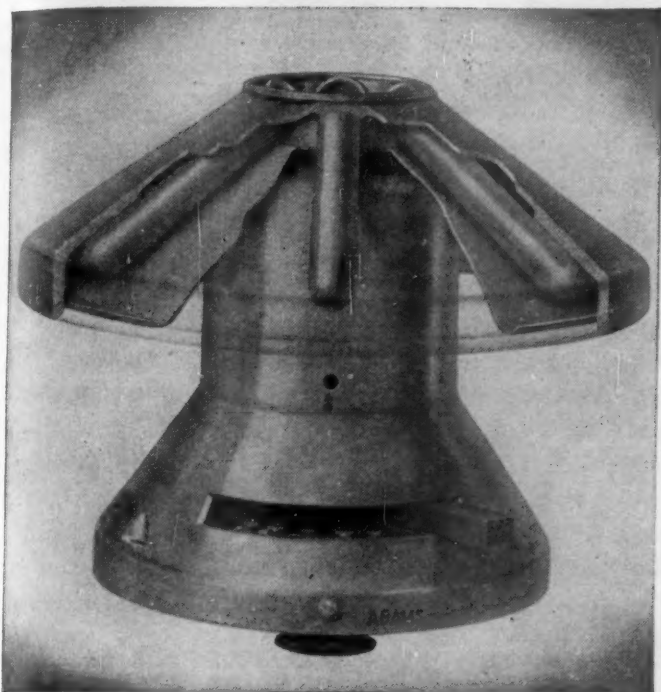
Almost half of these patients, 45 per cent., were alive at the end of the second year, they now report in the *Journal of Clinical Investigation*.—JANE STAFFORD.

## CONSCRIPTS REJECTED BECAUSE OF VENEREAL DISEASE

WORKS PROJECTS ADMINISTRATION "shock troops" of workers trained in non-technical aspects of venereal disease control will shortly begin assistance of rehabilitation of Selective Service registrants rejected because of venereal disease.

Rehabilitation of rejectees and workers in vital defense industries is part of a model venereal disease program outlined by the U. S. Public Health Service. Under it, young men rejected by the Selective Service or the Army because of syphilis or gonorrhea will be traced and encouraged to undergo treatment either by their private physician or at a public clinic. Further, infected persons in the civilian population near Army cantonments known to have passed their disease to soldiers will be traced and put under treatment.

The WPA shock troops will relieve sorely pressed doctors and nurses in contact tracing and clerical work.



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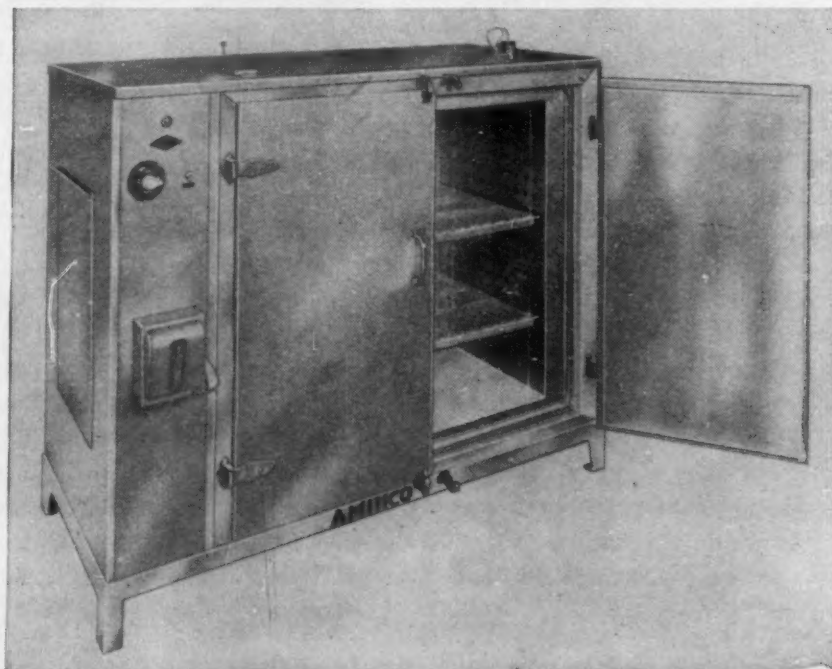
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They will be assigned shortly to aid the venereal disease programs in Colorado, Louisiana, Tennessee and Florida. Oklahoma, California and Oregon have just received their requested quota of WPA shock troops. These are states where mobilization and the booming defense industries have greatly increased the normal problems of venereal disease control.

The augmented venereal disease programs were made possible by allocation of \$5,015,864 in WPA funds by President Roosevelt.

### THE PSYCHOLOGICAL CORPORATION

HOWLER monkeys have a better foreign policy and scheme of international relations than science has yet taught man to use, according to Dr. Edward L. Thorndike, eminent educational psychologist of Teachers College, Columbia University.

At a luncheon meeting of the Psychological Corporation honoring its founder, Dr. James McKeen Cattell, pioneer psychologist, Professor Thorndike said:

"The howler monkeys manage the matter as follows: For the most part, each nation stays in its own territory, minding its own business.

"If one nation encroaches upon another's territory, the invaded nation meets them with a vigorous attack of howls.

"The invaders howl back.

"The contest continues until, by a beneficent provision in the brain of the howler monkey, the side that is out-howled is moved to retire. Not a drop of blood is spilt; not an atom of food or shelter is destroyed. No blot stains the national honor, since each citizen howls his loudest until his inner nature says 'Hold! Enough!' or 'Howled Enough!'

"The absolute justice of this procedure is dubious, since there may be a very low correlation between rightful ownership and vociferousness. But the outcomes are surely far better than in man, where the large wins over the small, the bellicose over the peaceful, and force over reason.

"It is an elementary principle of psychology that we should not try to dam up and push back the energy and passions of men, but should rather direct and entice them into desirable channels. It has been the world's tragedy of the last half century that effort was not made and ways were not found to encourage the energy and ambitions of the German people and of their rulers toward lines of action that would be good for them and for the rest of the world.

"It is perhaps impertinent to suggest that our governments should study psychology. But I can at least recommend that psychologists study government.

"If we do the work we should do in that field, we may hope to see psychologists attached to the Department of State."

### ITEMS

THE scientific exhibits at the National Academy of Sciences in Washington, which were placed there eighteen years ago by the General Electric Research Laboratory, have been removed to provide more space for scientists working on war problems. However, it has been an-

nounced by Dr. W. D. Coolidge, vice-president of the company in charge of research, that some of the exhibits will be shown at the meeting of the American Association for the Advancement of Science at their Christmas week meeting in Dallas, Texas. After that, the exhibits may be shown in museums and schools through the country and eventually be returned to the academy after the emergency.

THE Lisbon earthquake has been traced to its epicenter by seismologists of the U. S. Coast and Geodetic Survey, aided by observatories in the United States and Canada, reporting through Science Service by wire and radio. The spot under the ocean where the great shake centered is 600 miles southwest of Lisbon and 100 miles north of the Madeira Islands, in the region of latitude 34 degrees north, longitude 17 degrees west. Time of origin was 1:03.9 P.M., E.C.T., on Tuesday, November 25. The distance from Lisbon is approximately the same as that from Charleston, S. C., to Philadelphia. The epicenter may have been located deep beneath the sea bottom, possibly as much as 200 kilometers, or 125 miles.

CONTINUED high standards for this country's insulin supply, which means the difference between life and death for thousands of diabetic sufferers, will be maintained, if steps reported in the *Journal* of the American Medical Association are carried out. Insulin patent rights, which control the quality of insulin manufactured and sold in the United States and Canada, are now held by the Insulin Committee of the University of Toronto, where the insulin discovery was made. These patents expire on December 24. After that date, insulin can be made without license from the university, and consequently uninspected and unsafe insulin might get on the market. A flood of uninspected foreign brands, the *Journal* states, has already reached this country, to be distributed as soon as the patents expire. To meet the danger of unsafe insulin, the Board of Trustees of the U. S. Pharmacopeia has recommended that the U. S. Government take over the functions of the Insulin Committee when the patents expire. This would insure continuation of the double check on insulin standards—once by the manufacturer, once by the government. Under the proposal, the Food and Drug Administration would not release any product for general sale or distribution until it is assured that the product meets with standards and assays which the U. S. Pharmacopeia will specify.

A SEVERE malady, of which young women are the principal victims, has been successfully controlled by a rare and difficult operation pioneered by thoracic surgeons in the University of California Medical School. This affliction, bronchial adenoma, is caused by a tumor in one of the large bronchi, air passages which lead from the windpipe to the lungs. The condition is often mistaken for tuberculosis or cancer, and attacks young people mostly, 77 per cent. of the cases reported being under forty years of age and 64 per cent. of them women. The California doctors report that twenty of these operations have been performed, every one of them successfully, restoring patients to an active, normal life. They believe that the operation could be generally undertaken in such cases with a low mortality expectancy.

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By W. L. BADGER, The Dow Chemical Co., and E. M. BAKER, University of Michigan.  
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nology that have occurred since publication of the first edition. The book represents what is actually being done in industry—which processes are becoming obsolete, the relative importance of different processes, and the trends in equipment for those processes.

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ments, and encourages ability in research. Much new material has been added. Most of the experiments have been revised and a number of new ones have been added.

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## SCIENCE NEWS

*Science Service, Washington, D. C.*

## ASTRONOMICAL PROGRESS DURING 1941

WAR on the earth has not prevented astronomers from moving forward in their conquest of the heavens. A round-up on astronomical progress during 1941 by Dr. Bart J. Bok, of the Harvard College Observatory, shows a formidable battery of five new great telescopes getting into action: two already in use, one finished and being tested, two more due for completion early in 1942.

The two instruments already in action are a 20-inch Ross refractor at Lick Observatory in California and a 24-inch Schmidt telescope at the Warner and Swasey Observatory of the Case School of Applied Science in Cleveland, Ohio.

Twin 24-inch Schmidt telescopes are being constructed, one for Harvard College Observatory, the other for the new Mexican National Observatory at Tonanzintla, Puebla, which will be formally dedicated by President Camacho, late in February. The latter instrument will contribute importantly to astronomical research because of its favorable location at high altitude in low latitude.

The fifth wide-angle telescope under construction is also of the Schmidt type, but with a diameter of 48 inches. It will be mounted at the Hale Observatory on Mount Palomar in California. The mightiest of all pieces of astronomical artillery, the 200-inch reflector for Mount Palomar, will probably not be completed in 1942, but satisfactory progress is reported on both the great saucer-shaped mirror and its massive mounting.

"The effects of war are beginning to be more and more felt in the field of astronomy," Dr. Bok reports. "Many astronomers in the United States are now working on defense projects and the total output of scientific research is accordingly reduced." The slowing down of astronomical work has been reflected in the reduced volume of publication of astronomical research reports. In Britain, only about half the normal number of papers on astronomical subjects have appeared, and the German output has been even less, though the quality of work reported holds up. Surprisingly enough, in the conquered and occupied Netherlands, astronomers are apparently fully at work on their research programs again, and even in France interrupted observation and photographing schedules are being resumed.

Despite communication difficulties, astronomers in the warring countries manage to keep in touch with each other, and still maintain a considerable degree of the exchange of information that is indispensable for progress in what is probably the most completely international of the sciences.

## FREQUENCY MODULATION APPLIED TO TELEGRAPH LINES

TELEGRAPH lines now use the new FM radio, putting more messages over one circuit with less interference.

Western Union has announced the first use of frequency modulation or FM on its wire network to combat the

troubles caused by sharp weather changes that sometimes throw sensitive carrier currents out of balance.

FM radio (contrasted with the conventional AM or amplitude modulation of most broadcasting stations) invented by Major Edwin H. Armstrong is coming into use extensively in radio broadcasting stations of a new breed. FM gives radio signals that can not be disturbed by static. Static is not a trouble in wire telegraphic circuits, but there are other difficulties that FM does take care of.

Four telegraphic carrier current systems linking New York City with Buffalo, Chicago, Washington and Atlanta will be converted to FM operation. Future carrier systems will in general employ FM.

In order to send several messages simultaneously over the same wire, telegraph companies put several electrical currents of different frequencies on the wire. These are analogous to the carrier waves of different frequencies used in radio broadcasting. In the same way, at the other end of the wire are receivers each tuned to respond to only one of the several pitches. This is called carrier current system. Western Union at present uses twenty-two different frequencies.

The frequency corresponds to the pitch of a musical note. The single monotonous tone, however, would convey no intelligence. To do this, meaningful variations must be superimposed upon it. This is "modulation." Either the pitch or the intensity can be varied. The latter is amplitude modulation (AM). The former is FM.

Actually, neither in radio nor in wire applications of these principles is the carrier wave note heard. Its frequency or pitch is far above what the human ear can hear. Only the slower variations or modulations are converted by the receivers into audible sounds, or into motions that actuate a recorder.

Most external disturbances such as static are intensity or amplitude variations, whose pitch is within audible range, that are imposed on the carrier wave. If this is amplitude modulated, these disturbances add to and even drown out the signal modulations. But the FM receiver responds only or almost only to frequency variations and is very insensitive to amplitude changes. Hence the disturbances are not heard or are very much reduced.

## BAUXITE

BAUXITE, ore of aluminum, is one of the most impartially distributed of all strategic minerals. None of the warring powers has a monopoly of it. There are large deposits in both North and South America, to meet this country's requirements. Britain has Empire sources in India, Africa and Australia, and her Dutch ally in the Netherlands Indies. There are vast beds of bauxite in the U.S.S.R. The Axis powers, on their side, have mines in their own and in conquered territories: Hungary, Italy, Yugoslavia and France, with undeveloped deposits also in Greece and Rumania.

*Published in November*

# **SOUTHWESTERN ARCHAEOLOGY**

**By JOHN C. Mc.GREGOR**

*Archaeologist and Curator, Museum of Northern Arizona*

The only up-to-date book now available on the subject. Here for the first time is gathered a quite complete list of dated ruins. The book pioneers also in being the first to present a general unified picture of heretofore scattered or regional technical reports. It represents an important contribution to archaeological literature: It has, in fact, been hailed by a professor in one of our largest universities as "the most important contribution, of a general nature, on Southwestern archaeology since Kidder's work of the late twenties. It is the only authoritative up-to-date publication in that field."

Theoretical interpretations have been minimized throughout the book; instead the author has pointed out the broad and basic interpretations which lead to an understanding of historical processes and interrelationships, for these are essential for a knowledge of cultural influences and development. The volume is not intended to be exhaustive; it is, rather, an "organized framework" upon which the reader may build. "Southwestern Archaeology" is divided into two parts, the first of which presents a theoretical and general background. Here the aims, principles and methods of archaeology are set forth. A chapter is devoted to the history, application, capabilities, and limitations of tree-ring dating.

Part II offers an historical reconstruction of the prehistoric Southwest. The various stages of the cultures are treated in succeeding chapters; these are followed by a summary chapter on each culture, evaluating it in accordance with its history and achievements. A judicious selection of material has been made, and only the most important features of each period or culture are stressed. Brief bibliographies of the most pertinent literature appear in each chapter, and a more complete general bibliography is inserted at the end of the book. The concluding chapter of the book offers a general summary.

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The largest deposits in the United States are in Arkansas, but there are also workable beds in Alabama, Georgia, Mississippi, Tennessee and Virginia. The Aluminum Company of America, until now the only producer of aluminum directly from the ore in this country, has not worked the domestic beds to the limit, preferring to supplement the home supply with high-grade bauxite from Surinam (Dutch Guiana) and thereby conserve the ore resources within the boundaries of the United States. In addition to the Surinam bauxite, there are known to be immense deposits in Brazil, but these have not been opened up as yet.

Bauxite is a mineral that looks very much like hardened, fine-grained clay. Essentially it is an oxide of aluminum, with some water intimately bound in. But combinations of other elements are almost always found with it: iron, silicon and titanium principally, with much smaller quantities of calcium, magnesium, sulfur, manganese and chromium. In its purest form, bauxite is grayish white, slightly tinged with yellow; but presence of the other elements, notably iron, gives it a wide range of shades, from pink or yellow to dark red or brown.

The mineral gets its name from the village of Les Baux, in southern France, near the city of Arles. Here it was first identified and described by P. Berthier, just 120 years ago.

### CYCLOTRON TREATMENT OF CANCER

DR. JOHN C. LARKIN, research associate in the radiation laboratory, and Dr. R. S. Stone, professor of roentgenology in the Medical School of the University of California, reported at the San Francisco meeting of the Radiological Society of North America that sixty-one of one hundred and twenty-nine patients who faced death from advanced cancer have been saved and some of these perhaps cured by treatments with the great atom-smashing machine—results so encouraging that less advanced cases will now be treated by the physicians at the University of California.

One hundred and fifty-three patients have been treated during the three years. The 129 with which the report was concerned were treated with the 225-ton cyclotron; the remaining 24 with the 85-ton cyclotron.

Beams of neutrons—sub-atomic particles—are given off by the cyclotron during the atom-smashing process. These neutron beams are shot into the cancerous tissue, producing a marked shrinking of the tumor. The patient feels no sensation, however.

Drs. Larkin and Stone reported that cancer of the skin with extension into the underlying bony structures, cancers of the mouth and throat and primary cancers of the prostate gland have shown the best response to treatment. They said results are “encouraging,” and enough is now known about cyclotron treatment to start using it on patients with less advanced cancer.

### ITEMS

THE fifth annual Wright Brothers Lecture will be heard by members of the Institute of the Aeronautical Sciences on December 17, the anniversary of the first flights at Kitty Hawk in 1903. The lecture will be presented at

Columbia University by Professor Richard V. Southwell, British aerodynamics expert. He will speak on “New Pathways in Aeronautical Theory.” Dr. Charles G. Darwin, director of the National Physical Laboratory of England, who has been in this country for some months, will act as honorary chairman.

A RAINBOW at high noon, something very rarely seen in the sky, was visible for a short time at Washington on Friday, December 5, at exactly 12 o'clock. Because the sun was high, the bow (which always forms opposite the sun) was quite low in the northern sky, but distinctly outlined and with bright coloring. Screened by high buildings, it escaped the view of many persons in the downtown district, but even there it could be glimpsed up the vistas of north-and-south streets.

X-RAYS at million-volt intensity were used on fruit trees, berry bushes and vegetable seeds in the laboratories of the General Electric Company at Schenectady to change the physical set-up of the heredity-bearing cells and produce, if possible, new varieties of plants. The trees and bushes were exposed to the million-volt bombardment for an hour, the seeds for intervals stepped up from 12 to 60 minutes. They have been planted by genetic researchers at the New York State Experiment Station at Geneva. The exposures were conducted by Dr. Bernhard Nebel, of Cornell University, assisted by Dr. E. E. Charlton and C. D. Moriarty, General Electric research men.

A NEW 3,000-watt mercury vapor lamp, the largest of its type in the world, has been announced both by the General Electric and Westinghouse Companies. General Electric believes that the new lamp will be a boon for the lighting of steel mills, foundries and other shops where large areas require a lofty mounting of the lights. Westinghouse plans to use the lamp if possible for a new lighting of the torch of the Statue of Liberty. The 3,000-watt mercury lamp is a tubular light source 55 inches in length and a trifle over an inch in diameter. It is rated at 120,000 lumens, which is eight times more powerful than its nearest rival, a 400-watt mercury lamp. The new lamp gives twice as much light per watt as an incandescent lamp.

A NEW super-liquid state, in which the substance is much more fluid than it was originally, was found to occur in certain liquid films one molecule in thickness just before solidifying. The discovery was made by Drs. William D. Harkins, Lyle E. Copeland and George E. Boyd, of the University of Chicago, and was announced by them in a paper presented at the Chicago meeting of the American Physical Society. This is of course the opposite of the usual behavior of liquids in solidifying, which generally become more viscous (less liquid) as the freezing point is approached. The substances which showed this peculiar behavior were three forms of the higher alcohols which have high freezing points. They were particularly chosen because they have long, chain-like molecules like those of lubricating oils. The investigation is of importance in studying the behavior of lubricants, paints and cleaners.

## PREVIEW OF THE ANNUAL EXHIBITION

of the American Association for the Advancement of Science, Baker Hotel,  
Dallas, Texas, December 29 to January 1

The exhibition of the American Association for the Advancement of Science will this year be held at the Baker Hotel, Dallas, Texas, from December 29 through January 1, 1942. We again wish to express our appreciation for the cooperation that we have received from the exhibitors who have helped to maintain the high standards of the exhibition. Some institutions and concerns who have recently decided to take part in the exhibition have not had time to send descriptive material for publication in this issue of *Science*. A brief description of exhibits follows.

DORIS LEISEN,  
*Director of Exhibits*

### AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS

Agricultural Experiment Station

Booth No. 58

*Importance of Vitamin A in Animal Nutrition:* Photographs and charts are used to illustrate the economic importance of vitamin A and its precursors for farm animals. This includes effect on growth, production, reproduction and health, as well as the quality of the products from these animals for human food. Illustrations are shown for poultry, dairy and beef cattle, swine, sheep and goats. Mr. O. C. Copeland is in charge.

### AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS

Agricultural Experiment Station

Booth No. 57

*Genetics of Sheep and Goats:* Photographs of embryos up to sixty-two days of age resulting from breeding goats to sheep are exhibited together with aborted fetuses. Photomicrographs and drawings are shown of the chromosomes of both parent species and of the hybrid embryo. Photographs also are shown of the wild Mouflon, which is one of the parental species of domestic sheep, together with those of the  $F_1$  (Mouflon  $\times$  domestic sheep) and back-cross progeny. Samples and photomicrographs of coat covering are shown from each. Differences in tail-length and in number of coccygeal vertebrae of the parents and hybrid offspring are illustrated. Dr. B. L. Warwick is in charge.

### AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS

Agricultural Experiment Station

Booth No. 56

The use of colchicine in cotton breeding is illustrated by living plants of wild and cultivated species of cotton, sterile hybrids between wild and cultivated species, and fertile polyploids produced from sterile hybrids. Photographs show the chromosomes in normal species, hybrids, and colchicine induced polyploids. The origin of the tetraploid American cultivated cotton is illustrated with plant material. Dr. J. O. Beasley is in charge.

### AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS

Texas Agricultural Experiment Station

Booth No. 55

The scope of experimental work on the cotton root-rot disease (most destructive plant disease of the Southwest) is illustrated by charts, photographs and publications giving the results of field and laboratory research. Specimens showing the various stages in the life history of the root-rot fungus are displayed together with cotton plants showing the effects of the disease. Another phase of the exhibit deals with results of physiological studies on fruiting of the cotton plant as influenced by different soil-moisture and nutrient conditions. Dr. A. A. Dunlap is in charge.

### AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS

School of Engineering and Department of Physics

Booth Nos. 23, 24

This exhibit illustrates apparatus used and results secured in a research project determining compressibility factors for natural gas, without volume measurements, through a pressure range from atmospheric up to 4,000 lbs. per sq. inch. Metallographic specimens of ferrous and non-ferrous metals are exhibited for inspection under the microscope. Photographs and charts of apparatus being used in a research project on the continuous solvent extraction of cottonseed oil are exhibited. Demonstrations of a micrometer measuring changes in linear dimensions as small as one millionth of an inch are conducted. This apparatus was developed in the Physics Department in 1941 by J. R. Keeling, who conducts the demonstrations. Nomographic charts used in the solution of some intricate equations involved in a research project on design procedures for continuous structures are exhibited. Dr. Jakkula, in attendance, welcomes discussion with those interested in nomographic solutions. Photographs and drawings used in projects on low cost housing and elementary schools are exhibited.

### AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS

Booth Nos. 9, 16

**The Sciences Applied to Oil Fields:** This exhibit shows how measurements of various physical properties of the strata penetrated in drilling wells are used, together with the examination of fossils from the samples taken, to interpret the geological conditions under which oil and gas are accumulated in commercial quantities. The exhibit is illustrated by photographs of oil field operations, by samples of fossils, and by geologic cross-sections of typical oil fields. Some member of the Association's Committee on the Applications of Geology or of the Houston Geological Society, organizations which cooperated in the preparation of the exhibit, is in attendance during exhibition hours.

### AMERICAN ASSOCIATION OF SCIENTIFIC WORKERS

Booth No. 47

This exhibit illustrates how the Association is fulfilling its general aims of bringing scientists into closer contact with their fellow citizens and of effecting the participation of scientists in solving the problems which face our country. Examples are shown of the activities by the national organization and by the local branches having as their objects the following: (1) aiding national defense, national morale and the nation's health; (2) furthering the continuance of scientific work; (3) disseminating accurate scientific information; (4) preserving science and freedom of thought in war-time; and (5) acquainting scientists with facts and needs of many problems which involve social welfare. Some member of the Southwestern Division of the American Association of Scientific Workers is in attendance.

### BAUSCH & LOMB OPTICAL COMPANY

Rochester, N. Y.

Booth Nos. 18, 19

Visitors to the Bausch & Lomb exhibit will see not only a pictorial presentation of the vital part the company is playing in the National Defense Program, but also a most comprehensive display of its products. While the job of producing fire control instruments, optical glass and such of the regular products as are used by the Army and Navy is foremost, our efforts to continue to supply science and education with their optical tools will be the best under present circumstances. Visitors are cordially invited to discuss their interests with our representatives, G. Rohde and G. H. Leffler.

### BIOLOGICAL ABSTRACTS

University of Pennsylvania

Booth No. 8

A cooperative, non-profit journal published by biologists for biologists. Abstracting regularly more than 1,400 journals, including many foreign publications, *Biological Abstracts* is the only abstracting service in the world which covers the entire field of biology. It is now published in five sections as well as the complete edition. Starting in January, 1942, a new section will be pub-

lished comprising specially assembled abstracts of Animal Production and Veterinary Science. Dr. John E. Flynn, editor-in-chief, and H. I. Anderson, business manager, are in attendance to welcome visitors and furnish information.

### THE BLAKISTON COMPANY

Philadelphia, Pa.

Booth No. 6

During 1941 Blakiston published important books in the fields of agriculture, astronomy, biology, chemistry, hygiene, physics and medicine, all of which are on display in Booth 6. Be sure to see: the first four titles in The Harvard Books on Astronomy, Snell's "Biology of the Laboratory Mouse," Colin's "Elements of Genetics," the Third Edition of Meredith's "Hygiene," Mellan's "Organic Reagents in Inorganic Analysis," the Third Edition of Foley's "College Physics," Weber's "Temperature Measurement and Control" and the Fifth Edition of Gould's "Medical Dictionary." Mr. E. Raidy Stetson is in charge.

### CENTRAL SCIENTIFIC COMPANY

Chicago, Ill.

Booth No. 35

Cenco again displays the latest designs of scientific apparatus for the physics, chemistry and biology laboratory. Visiting scientists are invited to attend. Attention is called to "Selective Experiments in Physics," a series of approximately 150 experiments compiled by five prominent teachers of physics collaborating with Cenco's technical staff. Included in the exhibit are a novel student Spectrometer, the simplified Cenco-Edgerton Stroboscope, Explano and Micro-Explano Mounts, a low-cost High-Vacuum Unit utilizing a new all-steel Diffusion Pump and many other items. Representatives in attendance are R. D. Matthews and G. C. Godejahn.

### THE DALLAS PETROLEUM GEOLOGISTS

Booth No. 13

For the benefit of visitors interested in the geology of Dallas County, the Dallas Petroleum Geologists have prepared a bulletin. In addition to summarizing past work on the area, the bulletin contains a considerable amount of new information. Detailed descriptions of the surface formations are followed by an account of the subsurface geology and the geological history. A map showing areal geology is included. The bulletin and the map are exhibited and placed on sale at cost. Representatives of the Dallas Petroleum Geologists are in attendance.

### THE EASTMAN KODAK COMPANY

Rochester, N. Y.

Booth Nos. 11, 12

The exhibit of the Eastman Kodak Company includes the latest developments in color photography. There are examples of the new Kotavachrome and Minicolor prints made from Kodachrome transparencies. A fine display of Kodachromes in various sizes is also exhibited and the subjects range from scientific to pictorial. The equip-

ment display includes the latest cameras for black-and-white and color photography, also accessories and attachments for scientific photography. Mr. James Christy represents the Eastman Kodak Company.

#### THE GENERAL ELECTRIC COMPANY

Schenectady, N. Y.

Booth No. 41

The General Electric Company exhibit is a "push the button and make it work yourself" affair. A "sun motor" runs from the light energy developed by ordinary lamps; an aluminum dish floats in air; "smoke" clouds of mercury appear; an Alnico "tumble-bug" puts on a show. The exhibit also includes an integrating exposure meter, a portable X-ray diffraction unit, a strain analyzer, an electrodynamic ammeter, an Alnico floating magnet and gauges for measuring the thickness of molecular films by means of interference colors. L. H. B. Peer, of the General Electric Research Laboratory, is in charge.

#### THE GRADWOHL SCHOOL OF LABORATORY TECHNIQUE

St. Louis, Missouri

Booth No. 38

This exhibit is designed to show teaching methods in relation to Frozen Section work on pathological tissues. Together with the Frozen Section Method, new and important methods of tissue staining are demonstrated: first, a new method of differentiating Gram positive from Gram negative organisms in tissue; second, rapid staining of spirochetes in tissue; third, demonstration of fat; fourth, Giemsa staining. Mr. and Mrs. Lucian Erskine represent the school.

#### KANSAS AGRICULTURAL EXPERIMENT STATION

Booth No. 29

(L. E. Melchers, F. A. Wagner and A. E. Lowe)

This exhibit illustrates research in breeding for resistance to the milo disease of sorghums. Photographs show the various steps followed in selecting resistant plants in the field and greenhouse; how these selections are further tested to eliminate accidental "escapes," segregates or varietal mixtures, and how disease reaction and agronomic characters may be determined in infested soils. The inheritance of resistance to disease is illustrated and segregation in Mendelian ratios is shown in hybrid material grown in infested soil in the greenhouse. The use of greenhouse methods is demonstrated in testing certified seed of resistant strains of milo. Photographs illustrate how growers and County Agents have soil from questionable fields tested for the presence of disease. Living plant material of resistant and susceptible selections and varieties of sorghum growing in infested soil are an important feature of the exhibit.

#### THE LINGUAPHONE INSTITUTE

New York, N. Y.

Booth No. 28

At the Linguaphone exhibit visitors are given an opportunity to have a free demonstration of this unique language-teaching method. There are courses in 29 lan-

guages including Spanish, Chinese and Hindustani. The student looks into the illustrated text-book and as his eyes scan the printed text he hears it spoken in clear native accent by an eminent educator whose voice comes from the phonograph. That is the essence of the method. Repetitious hearing, at the student's own convenience, makes for rapid progress. Through the use of this method, many have learned a European language in four months and oriental languages within a year. Mr. Max Sherover is in charge.

#### THE MACMILLAN COMPANY

New York, N. Y.

Booth Nos. 36, 37

The exhibit sponsored by The Macmillan Company this year contains about 900 volumes. Both undergraduate and graduate texts are displayed, along with many outstanding reference books, and technical and scientific books designed for the general reader. The following classifications are included: Agriculture, the Biological Sciences, Chemistry, Engineering, History of Science, Home Economics, Mathematics, Medical Sciences and Physics. Representatives of The Macmillan Company in attendance at the exhibit are: Mr. Charles L. Skelley, Mr. Joseph B. Bennett, Jr., Mr. Donald M. Nelson, Mr. Frank Driskill and Mr. Arthur Evans.

#### McGRAW-HILL BOOK COMPANY

New York

Booth No. 10

Advance proofs of important forthcoming books in the field of science are on display at the McGraw-Hill booth. You are invited to see at this booth also an exhibit of recent McGraw-Hill books in the fields of Agriculture, Astronomy, Biology, Chemistry, Economics, Forestry, Geography, Geology, Mathematics, Metallurgy, Photography, Physics and Psychology. Messrs. Curtis G. Benjamin, Kenneth B. Demaree and Whitman Daniels are in attendance at the booth.

#### METRIC ASSOCIATION

Booth No. 17

The exhibit of the Metric Association features the fundamental standards of length, mass and volume. Various rules and measuring devices using the metric system are displayed. A chart of the metric system, edited by the Metric Association, and the use of the system in derived measures such as specific gravity, mechanical equivalent of heat, watts and kilowatts, are exhibited. Emphasis is placed upon the use of the metric system in commerce and in the home, and upon the desirability of its world-wide adoption. Dr. J. T. Johnson and D. L. Barr are in charge of the exhibit.

#### NATIONAL GEOGRAPHIC SOCIETY

Washington, D. C.

Booth Nos. 20, 21

Work of Expeditions and Studies in Five Fields: Preliminary results of the work of five recent scientific expeditions and investigations under the sponsorship of the National Geographic Society are shown in the exhibit of the society. Rare fossil bones found in the Badlands of

South Dakota illustrate work in paleontology; art objects from a pre-Christian-era civilization in southern Mexico represent archeology; and photographs, charts and one of the largest spectrograms ever made, obtained during the total eclipse of the sun, present astronomical data. Unusual photographs and charts depict progress of a three-year investigation of auroras, and oceanographic studies of the sea bottom. Mr. McKerbey and Mr. Roy are in attendance.

#### NORTH TEXAS BIOLOGICAL SOCIETY

Booth No. 34

This exhibit portrays some of the notable research which is being conducted by members of the North Texas Biological Society: A movie of microscopic life in North Texas lakes is shown. Typical microfauna and flora of reservoir lakes are displayed under demonstration microscopes. Charts and specimens show the distribution of North Texas acridians. There is a paleoecological chart of the bathymetric distribution of cretaceous ammonites. Some member of the society is in attendance at all times.

#### NORTH TEXAS STATE TEACHERS COLLEGE

Department of Chemistry

Booth No. 22

The exhibit on the sweet potato endeavors to tell the story of the chemurgic industrial possibilities of the sweet potato. It is a rather startling fact that the poor, sandy soils of the South can produce twice as much wealth by growing sweet potatoes as the richest corn land in the Midwest can produce on the average with its fine corn. This exhibit strives to tell the story as well as to show a number of the actual products processed from the sweet potato in the Farm Industrial Laboratories of North Texas State Teachers College. Mr. Everett Scogin is in attendance at the booth.

#### UNIVERSITY OF OKLAHOMA

Department of Botany

Booth Nos. 32, 33

This exhibit presents the method, scope and results of a cooperative research project, directed by Dr. O. J. Eigsti, for more than 300 amateur experimenters using colchicine. Chemicals, treated and untreated plants, directions for experimenters, charts, maps, photographs and demonstration of technique form a vital part of this presentation. The educational aspects and effectiveness of such experiments are analyzed. The pollen tube method as used to test the effect of colchicine upon mitosis, and for other cytological studies, is to be demonstrated. Photomicrographs and microscopic slides illustrating the histological and anatomical effects of colchicine upon the tissues of *Vinca rosea* are displayed by Dr. G. L. Cross.

#### PRENTICE-HALL, INC.

New York

Booth No. 7

Approximately two hundred widely used books in the fields of *Physics, Chemistry, Mathematics, Physiology, Geology and Geography, Psychology, Education, Engi-*

*neering, Home Economics, Agriculture, and Management* are on display. Special attention is directed to such books as *THE PHYSICAL SCIENCES, PROCEDURES IN EXPERIMENTAL PHYSICS, SEMIMICRO QUALITATIVE ANALYSIS, SEMIMICRO EXPERIMENTS IN GENERAL CHEMISTRY, COLLEGE PHYSICS: Abridged* and *COLLEGE ALGEBRA*. Literature on new and forthcoming books is available. Mr. Norman Arnold and other members of the Prentice-Hall organization are in charge of the display.

#### RCA MANUFACTURING COMPANY

Booth No. 52

This exhibit consists of continuous motion pictures on the subject of the electron microscope, stereoscopic viewing devices to illustrate the latest three-dimensional accomplishments of the microscope, as discussed in the Zworykin-Hillier paper, and photo enlargements of studies of insects made by means of the microscope, as discussed in the Richards-Anderson paper. (Both of these papers are on the Monday, Dec. 29, program of the American Association of Physics Teachers.) The electron microscope may itself be seen by scientists obtaining special passes which are issued at this booth. In attendance are E. T. Jones, P. C. Smith, J. P. Taylor, W. M. Witty and C. E. Davis.

#### W. B. SAUNDERS COMPANY

Philadelphia, Pa.

Booth No. 48

The exhibit includes a complete line of text-books and reference books dealing with the medical and biological sciences. Of special interest are the new text-books, "Human Anatomy and Physiology" by Millard and King, "Vitamin K" by Butt and Snell, "Physical Medicine" by Krusen; and the new editions of "Textbook of Bacteriology" by Jordan and Burrows, "Developmental Anatomy" by Arey, "Fundamentals of Chemistry" by Bogart, "Personal Hygiene Applied" by Williams, and "Public Health and Hygiene" by Bolduan. The representatives present during the convention are Messrs. John A. Behnke and Paul E. Koerfer.

#### SCIENCE CLUBS OF AMERICA

Booth No. 49

At the exhibit of the Science Clubs of America, an international organization of amateur scientists which is sponsored by Science Service of Washington, D. C., one may meet some of the nation's outstanding young scientists as well as honorary members of the American Association for the Advancement of Science. An interesting feature of the exhibit is the drape backdrop made from a single width weave of spun glass (fiberglass) 72 inches across, emblazoned with the insignia of the Science Clubs of America. The exhibit includes photographs portraying science clubs activities, a display of *THINGS of Science*, newspaper releases and *Science News Letter*. Material of interest to all science club sponsors is available.

#### THE SCIENCE LIBRARY

Publications of 1941

Booth Nos. 30, 31

This display is a popular part of the annual exhibition of the American Association for the Advancement of

Science. It is a collection of approximately five hundred volumes issued during 1941 by more than fifty publishers. Those attending the meetings and exhibition are invited to visit the Science Library. It is a convenient place for members to meet their friends. Tables and comfortable chairs are conducive to a leisurely examination of the books. Reprints from the January, 1942, issue of *The Scientific Monthly*, in which the publications are catalogued, are distributed without charge to those interested. Miss Dorothy Amann, librarian of Southern Methodist University, is in charge.

### THE SOUTH-WESTERN BIOLOGICAL SUPPLY COMPANY

Dallas, Texas

Booth No. 53

This exhibit displays biological specimens and demonstration preparations in a colorful manner. On display are a Texana Invertebrate Test Collection of one hundred specimens, Parasitological material, Flexible Crayfish and Flexible Grasshoppers, Isely Insect Breeding Cage, Texana Inexpensive Insect Boxes, New Style Terrariums and other developments of interest to biologists. Mr. and Mrs. Ottys Sanders are in attendance.

### SPENCER LENS COMPANY

Buffalo, N. Y.

Booth Nos. 42, 43

The Spencer exhibit displays several recently developed instruments, including a projection device to assist in reading material on microfilm called the Microfilm Reader, a new Polarimeter, a new Universal Microscope Lamp for producing different types of illumination and Fluorescent Accessories for the examination of T.B. bacteria. The standard instruments, microscopes and projection equipment, for which Spencer is well known, are also on display. Three Spencer representatives are in attendance—Mr. W. L. Reynolds of Dallas, Mr. C. M. Osborne of St. Louis and Mr. E. V. Finnegan of Chicago.

### THE UNIVERSITY OF TEXAS

Booth Nos. 14, 15

The University of Texas presents a display of research projects on foods consisting of Dr. Roger Williams's study of vitamins, Dr. Jet Winters's study of low-cost diets and Luis H. Bartlett's new quick-freeze machine. Dr. E. H. Sellards of the Bureau of Economic Geology presents a display on the Odessa meteor—model of the crater, photographs, samples of meteorites. Also included are samples of native Texas building stone, ceramics and fine clays.

### THE UNIVERSITY OF TEXAS

Division of Physiology

Booth No. 25

This exhibit, presented by Dr. E. J. Lund, his associates and students, consists of unique equipment especially built for carrying on experiments in measuring the production of electricity by polar tissues, the absorption of electricity by roots, the effect of gravity on the electric potential of plants, the potentials in a single cell, and the absorp-

tion of water by a single cell. Dr. Lund or his associates are in attendance at the booth to demonstrate the equipment to visiting scientists.

### TEXAS POWER AND LIGHT COMPANY

Dallas

Booth No. 59

This exhibit describes the various natural resources of the State of Texas. On a colored map the locations of mineral deposits throughout the state are indicated and samples of each are displayed. The Texas Power and Light Company, which serves a 52-county area within the state, through its Industrial Research Division is making an extensive study of the resources of Texas, and is aggressively promoting an industrial and agricultural development based upon their utilization. This exhibit calls the attention of visitors to the economic opportunities of the area. Messrs. J. L. Tullis and O. K. King, Jr. are in charge.

### TULANE UNIVERSITY OF LOUISIANA

Department of Tropical Medicine

Booth No. 44

"Histoplasmosis: A Systemic Fungus Infection"—The distribution of reported cases, the life cycle of the causative organism, the pathology and symptomatology of the infection, and the laboratory methods of diagnosis are demonstrated on wall charts. Microscopic demonstrations show the histopathology, the fungus in a bone marrow smear and a tissue section, and material from cultures maintained at 37° C. and room temperature.

### THE UNIVERSITY PRESSES

A Cooperative Exhibit

Booth Nos. 26, 27

This exhibit shows recent books and journals representative of contributions to the general field of science. Some three hundred books on the sciences and a representation of general, recent publications dealing with history, economics, literature, and other new publications by the various university presses are included. Among the cooperating university presses are Yale, Michigan, Duke, Oxford, Columbia, Cornell, New Mexico, Iowa State, Chicago, Pennsylvania, Stanford, Illinois, Minnesota, Princeton, Harvard and Oklahoma. Mr. L. J. Carrel, of the University of Oklahoma Press, is in attendance.

### JOHN WILEY & SONS, INC.

New York

Booth No. 54

The display consists of the recent books published in all the fields of science and technology covered by the publications of the company. New books of interest are Buerger's "X-Ray Crystallography," Merriman's "To Discover Mathematics," Miller's "Unconsciousness" and Blatt-Gilman's "Organic Syntheses," the Collective Volume I, appearing in its revised edition. The company is represented at the exhibit by Mr. W. B. Wiley and Mr. W. G. Stone.

## SCIENCE NEWS

*Science Service, Washington, D. C.*

## SCIENTIFIC RESEARCH AND THE WAR

AMERICAN science is being marshalled for war with as much vigor as possible and the scientists in deep secrecy have been hard at it for over eighteen months. The beginning of actual war in the Pacific will make little difference in the tempo of scientific research for America's defense. In the full realization that it takes months for a new weapon to evolve from the idea to something useful on actual battle line, on the sea, in the air or on land, American scientific forces sprang into full activity within a few weeks after the fall of France.

A new division of the government's defense machinery was created to speed the application of defense to warfare. This effort is headed by Dr. Vannevar Bush, who is now director of the Office of Scientific Research and Development of the Office for Emergency Management. The National Defense Research Committee, first under Dr. Bush and now under President James B. Conant, of Harvard University, started the push last year, enlisting for its many projects the bulk of the physicists in America and thousands of other scientists.

This is a physicist's war just as the first world war was a chemist's war. The job this time is to devise protection against magnetic and acoustic mines, spot airplanes by various physical means, make bigger and better weapons or improvements in older weapons, devise better airplanes that fly faster, farther and carry more bombs. Of course in doing the scientific job in the war, chemistry, and even medicine, biology and psychology, play important rôles. New explosives, new methods of keeping soldiers, sailors and airmen healthy, better methods of treating the wounded—all these are important. Medical experts, too, have been mobilized for months, many committees for civilian medical research workers, army, navy and public health surgeons, working together. Dr. Lewis H. Weed, of the Johns Hopkins University, as chairman of the National Research Council medical committee, has been a key man in this medical effort.

The public too have been earnestly invited to volunteer its ideas and suggestions for applying invention to the war. The National Inventors Council under the chairmanship of Dr. Charles F. Kettering has received over 30,000 inventive ideas, and every suggestion of possible war usefulness has been given a prompt hearing by Army and Navy experts.

Committees of psychologists and psychiatrists have been hard at work, helping in pilot training, morale, and other aspects of the war effort.

The Navy in recent months, already relying heavily on its Naval Research Laboratory, called Dr. J. C. Hunsaker to head its science and research activities. Dr. Hunsaker is also chairman of the National Advisory Committee for Aeronautics, long in the forefront of airplane design and development. The NACA laboratories are now playing an increasingly important part in our aviation program.

Old-line research organizations in the government have accelerated their war work—the National Bureau of

Standards in various fields, the Bureau of Mines and the Geological Survey in discovering new deposits of strategic minerals, the Department of Agriculture in food research, the U. S. Public Health Service in disease protection.

The National Roster of Scientific and Specialized Personnel under Dr. Leonard Carmichael, president of Tufts College, has listed thousands upon thousands of scientists for possible war service as the war effort grows.

Close cooperation of American scientific effort has been effected with the British scientific war work. Dr. Charles G. Darwin, director of the British National Physical Laboratory, has been in this country for months as liaison officer.

One important phase of America's application of science to war is that scientists are being put to work on important war problems in their own laboratories or in industrial and university research institutions best fitted to do the particular job needed. New ideas needed by Army and Navy are tried out promptly and vigorously with a minimum of red tape. It was made known a few months ago that some of the new research developments made in America had seen actual use on the field of battle. This will be increasingly the case in weeks to come.

Science is enlisted for the duration. Its effectiveness will be announced to the enemy by action rather than any news of progress that has been made.—WATSON DAVIS.

## THE UNITED STATES MEDICAL COMMISSION TO THE YUNNAN-BURMA RAILROAD

JAPAN'S sudden attack on this nation gravely imperils the life of at least one and possibly several American scientific men believed to be in the Burma Road area where they were commissioned to fight malaria among Chinese builders of the Yunnan-Burma railroad. These scientists are members of the Medical Commission to the Yunnan-Burma railroad appointed last August by Surgeon-General Thomas Parran of the United States Public Health Service at the request of the Chinese Government.

Dr. Victor H. Haas, Public Health Service officer and chief of the commission, is known to have arrived in the Chinese Province of Yunnan on the Burma border. His last report, written five weeks ago, has been received by the Public Health Service at Washington.

Other members of the commission supposed to be either with Dr. Haas or on their way when Japan struck are: Dr. Fred P. Manget, American missionary physician; Dr. Marshall Balfour, chief of the Far Eastern Division of the Rockefeller Foundation; Dr. Paul Stephenson, formerly of the Peiping Union Medical College; Dr. W. L. Jellison and H. A. Johnson, of the Public Health Service; Frank W. Fisk, University of California; D. E. Wright, Rockefeller Foundation; F. W. Thomas and E. R. Lacy, Tennessee Valley Authority; L. B. Hall, Georgia State Department of Health; Arthur B. Morrill, Detroit Water Board.

Gordon Smith, entomologist of the Tennessee Valley

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Authority, and Joseph Pasterski, Jr., Public Health Service clerk, are in San Francisco where they intended to leave shortly for Burma. Dr. T. H. Tomlinson, of the Public Health Service and executive officer of the commission, also was to have joined the commission. Their plans are now uncertain.

### THE POSSIBILITY OF A CHOLERA EPIDEMIC IN JAPAN

EFFECTIVE bombing of Japan's crowded, inflammable cities might easily give rise to an epidemic of Asiatic cholera, is believed by U. S. Public Health Service epidemiologists. Two cases of cholera in at least one Japanese province (Taiwan) have been reported to the Public Health Service this year, and it is believed many more occurred. Cholera prevails in the Far East, but there is none in the United States.

Cholera is spread by eating raw foodstuffs and drinking water infected with the microscopic curved rods which are the cholera germs. Normal supervision of these sources would be disrupted by severe bombings of Japanese "paper" cities. A far higher number of people would be made homeless in Japan by bombings than in this country where living quarters are less crowded and more durable.

In addition, there are the dangers of typhoid fever epidemics among a coolie population suddenly driven from their supervised water and food supplies by fire and high explosives. Watchful Japanese health authorities have been able so far to prevent epidemics so far as is known, because to date no Japanese city has been severely bombed. Health authorities here believe, however, that mass destruction from air raids might easily bring the ravages of disease to a population already suffering from the strain of years of war.

Beriberi, another disease long known as a plague of Japan and other Oriental countries, is caused not by germs but by poor diet, specifically one lacking the morale vitamin B<sub>1</sub>. The Japanese navy lost large numbers of its personnel from beriberi in the nineteenth century before the cause of this disease and the proper diet for preventing it were discovered. Long after it was banished from the navy it continued to afflict the civilian population, but the Japanese authorities have in recent years been trying to improve the nutritional status of the people. So far as beriberi is concerned, according to latest figures available, the death rate has been declining.

### ITEMS

A CURE for athlete's foot which stops itching immediately and leaves no stain on skin or clothing is announced by Dr. Edward Francis, medical director (retired) of the U. S. Public Health Service, in the current issue of the *Journal of the American Medical Association*. The remedy consists of a mixture of three parts phenol and one part camphor which can be prepared by any pharmacist. He reports that the mixture is "non-irritating and may be painted between the toes several times a day. The sock may be replaced immediately without danger of corrosion." Users are warned, however, that the preparation should not be applied to wet skin.

A NEW plastic fabric for upholstery that is said to be stainproof, fireproof and practically as tough as steel is getting attention at the Modern Plastics Exposition at the U. S. Department of Commerce. The new material is being tried on New York subways and is being investigated by the U. S. Maritime Commission for upholstering furniture on new passenger ships. That the fabric can be washed with soap and water, does not retain heat like some chair covers, and is tough as steel are among claims made for it by the exhibitors, the Firestone Tire and Rubber Company. Known as Saran, the material is a thermoplastic resin extruded in strands or yarn of various sizes and gauges that can be woven like cloth. It can be produced in practically any weave or color used in producing cotton, silk or other textiles and can be combined with these to make original patterns. Besides upholstery, its uses are expected to extend to table tops, airplane partitions and room interiors.

A NEW "robot chemist," that automatically and continuously measures the amount of chlorine dripped into city water, was described in the course of a discussion of water supply sanitation at the General Electric Science Forum by Edward E. Minor, vice-president of the New Haven, Conn., Water Company. Practically all city water supplies are now chlorinated, to insure their freedom from harmful bacteria. The germ-killing process absorbs the chlorine and, if the introduction of the chemical is properly controlled, the excess is kept to a very low level. Less than this amount is not safe; more makes the water disagreeable to some persons. Until the present time, the only way to regulate the chlorine excess was to keep a chemist busy all the time making routine chlorine analyses. In the new process two electrodes, one of silver, the other of copper, are introduced into a slowly flowing stream of water. The amount of current passing between them is affected by the concentration of chlorine in the water. If it drops below the safe point, a relay in the apparatus increases the rate at which chlorine drips into the water; if it rises above the tolerable excess the amount of chlorine introduced is automatically reduced.

By the use of "heavy" water, that is, water in which the two atoms of hydrogen that are combined with one of oxygen are twice as heavy as in ordinary water, investigators of the National Bureau of Standards have succeeded in producing a more constant standard volt. The final tests of the new standard were made by Dr. G. W. Vinal, chief of the electrochemical section, assisted by Mrs. L. H. Brickwedde. The standard volt is obtained from a standard battery cell which is made with extreme care according to very precise specifications. All other voltages are measured in terms of the voltage given by this cell. Just as the standard of length, preserved by the bureau, must always give the same length, this cell must always give the same voltage. The bureau has several such "standard cells" and, although very satisfactory, they require a certain period of aging before they settle down to a truly constant voltage and can be used. After seven years of research in the effort to improve the standard cell, it was found that by using a large percentage of "heavy" water in the liquid of the cell, its performance was improved and the aging period reduced.

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## SCIENCE NEWS

Science Service, Washington, D. C.

## MEETINGS OF SCIENTIFIC SOCIETIES

THE traditional science meetings during the Christmas-New Year holidays will be held this year despite the war. About a hundred scientific societies will attract thousands of scientists to over a dozen cities throughout the nation.

Service to the nation in war and peace will be the predominant theme of most of the scientific reports. Many meetings will have sessions for the discussion of how science can help more effectively the nation's war effort.

Most of the meetings begin Monday, December 29, and continue through New Year's Day.

Dallas, Texas, is the scene of the meetings of the American Association for the Advancement of Science and its associated societies.

The two mathematical societies will meet at Bethlehem, Pa.

Physicists will hold meetings at Princeton, N. J.

Chemists will attend important symposia at Cleveland, Ann Arbor, Mich., and Columbus, Ohio.

Geologists and paleontologists will meet at Boston.

Baltimore will be the scene of bacteriology meetings.

Economic entomologists have picked San Francisco.

Archeologists and anthropologists will go to Andover, Mass., while another archeological group convenes at Hartford, Conn.

New York will be the gathering place for the social science societies, notably the American Economic Association, the American Sociological Society and the American Statistical Association.

Historians and librarians will hold their meetings at Chicago.

WATSON DAVIS.

## WEATHER FORECASTS

WITH the daily maps and forecasts by the U. S. Weather Bureau suspended, except in a very limited way that will give no aid or comfort to the enemy, local weather prophets may be expected to come into their own. For it may be taken as assured that people aren't going to stop talking about the weather.

There is, of course, good reason for the "blackout" of the daily weather maps and the detailed weather reports. Weather doesn't stay put, but constantly drifts in a generally easterly direction, so that an announcement of storm or fair skies over the Atlantic seaboard to-day could be used to advantage by Nazi U-boat commanders to-morrow or the next day.

However, local conditions can be guessed at with more or less accuracy, especially by observant old-timers who don't depend too much on patent-medicine almanac "rules." Quite a good many of the old-fashioned "signs" have good scientific warrant, even though others lack solid foundations.

Back of the old jingle, "Red in the night, sailors' delight; red in the morning, sailors take warning," is the truth that bright sunsets usually come during periods of settled weather, while a reddened sun (at any time of

day) indicates the presence of moisture-laden particles in the air, that may later precipitate rain or snow. Even at sunset, a bleary, reddened sun (as distinguished from red-tinted clouds) may warn of storm to come.

A rising column of smoke from a chimney is another fairly reliable "sign" of fair or clearing weather. It means that the air is dry, whereas smoke that goes up and then comes down again shows that the air is heavy with moisture which the smoke particles gather unto themselves until they are so heavy that they sink.

A ring around the moon, or to be academically precise, a halo, is another fairly dependable weather "sign." So is a fuzzy or blurry appearance of moon or stars. These appearances are due to the interception of light by thin clouds running ahead of an approaching general storm area.

There is, however, no truth whatever in the belief that the crescent moon "holds" rain if its horns are pointed upward, "pours" rain if they point downward. Those phenomena are purely astronomical, and have nothing to do with conditions on earth. The same holds true for the position of the "bowl" of the Great Dipper as seen early in the evening.

## INFLUENZA

PREVENTION of influenza epidemics may be possible by spraying a mist of the chemical, propylene glycol, into the air of schools, barracks, industrial plants and other places where large numbers of people gather.

Such a mist protected mice from the virus of influenza A in tests reported by Dr. Werner Henle and Dr. Joseph Zellat, of the University of Pennsylvania School of Medicine and Children's Hospital, to the Society for Experimental Biology and Medicine.

No signs of influenza developed in mice exposed to the flu virus by spraying it through an atomizer into the test chamber when propylene glycol was also sprayed into the chamber. When exposed to the virus in a similar way without the propylene glycol mist, more than 50 per cent. of the mice developed influenza.

Nearly 50 per cent. of the mice exposed to the virus without the propylene glycol mist died, but only one mouse died in the group in which the mist as well as the virus was sprayed into the test chamber.

The propylene glycol mist is odorless, does not appear to stain or cause a noticeable film and the chemical has no poisonous effect on humans in the quantities used to create the mist. Its effectiveness in sterilizing air by killing bacteria had previously been announced by Dr. O. H. Robertson and associates, of the University of Chicago.

The tests at Philadelphia show that it is effective against at least one virus as well. They conclude that "propylene glycol aerosol (mist) reduces the chances of air-borne infection with the virus of influenza A and may be effective in preventing air-borne spread of the disease. The practicability of its use for this purpose has to be investigated."

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### THE TUBERCULOSIS GERM

DISCOVERY of chemicals in the bodies of young mice which destroy the drug-resistant waxy parts of the tuberculosis germ was announced by Dr. Bruno Gerstl of Yale University and Dr. Robert M. Thomas, also of Yale, at a meeting in Washington of the Committee on Medical Research of the National Tuberculosis Association.

Two years ago new-born mice were found to be immune to tuberculosis. A search was begun for the factor responsible for that immunity. After analysis of the body organs, Dr. Gerstl concluded that the factor or factors were enzymes, chemicals produced by body cells which assist the life processes. When introduced into test tubes containing tuberculosis germs, the mouse enzymes broke up the fatty parts of the germs. The fatty components are believed to have defeated all attempts to kill the germ by drugs.

Commenting on Dr. Gerstl's announcement, Dr. William Charles White, chairman of the committee, stated that: "Dr. Gerstl's discovery . . . might lead to development of a preparation from the enzymes which will have a lethal effect on the germs within the human body."

A new method of following the course of tuberculosis in the body was described by Dr. Florence B. Seibert, of Henry Phipps Institute, Philadelphia. She traced the rise and fall of albumin and globulin, constituents of the blood serum. To an old and baffling question, Dr. Seibert gave these answers: the albumin content of the blood always drops during tuberculosis; the alpha-globulin rises when the patient is improving; the gamma-globulin falls during the period of improvement, and the beta-globulin always rises just before death. With these standards, analysis of the blood during tuberculosis can now be made as a diagnostic and prognostic procedure.

Variation in the virulence of the human, bovine and avian (bird) strains of tubercle bacilli was described by Dr. C. E. Woodruff of William H. Maybury Sanatorium, Detroit. Dr. Woodruff has developed a new method of studying the virulence of tuberculosis germs by spreading the different strains on the omentum of guinea pigs, a membrane supporting the intestines.

### VITAMINS

IRREPARABLE paralysis and other signs of brain injury might result if babies did not get vitamin A, although this vitamin from butter and yellow vegetables like carrots is not necessary for the growth or function of the brain and spinal cord. This seeming paradox was reported by Dr. S. B. Wolbach, of the Harvard Medical School, at the meeting in New York City of the Association for Research in Nervous and Mental Disease. The damage to the nervous system with paralysis or other grave result caused by vitamin A lack is due to the fact that this vitamin is necessary for bone growth. If the vitamin is lacking during early growing periods, bone growth is markedly slowed. The brain and spinal cord are enclosed by bone. When they grow too large for the stunted skull and the rest of the bony envelopment, the consequent squeezing causes striking deformities in brain,

spinal cord and nerve roots. Dr. Wolbach and Dr. O. A. Bessey found that in experimental animals, irreparable paralysis and other signs of brain injury resulted. They are convinced that acute uncomplicated deficiency of vitamin A in the human infant would produce similar results, but have not had an opportunity to verify this.

That vitamins may be divided into two groups, those needed to prevent brain and spinal cord degeneration and those not required for maintenance of nervous structure, was reported by Dr. Harold E. Himwich, of Albany Medical College, Union University. The vitamins needed by the central nervous system included vitamin B<sub>1</sub> (thiamin, the morale vitamin), nicotinic acid amide, riboflavin, pantothenic acid, vitamin B<sub>6</sub> and vitamin A. Vitamin B<sub>1</sub> plays an important part in the processes supplying energy for brain functions, helping the brain tissues to get energy from their chief foodstuff, the sugar and starch group. Lack of this vitamin not only produces biochemical disturbances in the central nervous system, depressing brain activity by interfering with conversion of food into energy. Lack of the vitamin also produces characteristic neurological changes in the part of the body controlled by the portion of the brain affected. Rats deprived of the vitamin and unable to walk, for example, were found to have a depression of brain metabolism (energy interchange) in the part of the brain containing the nerve centers that govern movement. Treatment of diseases will improve, Dr. Himwich pointed out, when scientists gain more such knowledge about the specific effects produced on body tissues by lack of the other vitamins.

### RECOORDINATION OF MUSCLES IN INFANTILE PARALYSIS

SIGNALS flashed in a bulb by the electrical energy of transplanted muscles are helping infantile paralysis victims to learn to walk, Dr. Dallas B. Phemister, of the University of Chicago, reported at the medical meeting in New York City of the National Foundation for Infantile Paralysis.

The muscle electric flash signal is used, he explained, for patients of fairly low mental aptitude. Such patients usually are unable to get muscle recoordination clues from either a sense of position or from watching the kneecap being retracted. In these patients the lower end of the muscle that bends the knee, located on the under and outer portion of the leg above the knee, is transferred to the paralyzed quadriceps muscle at its lower end on the kneecap. The quadriceps is the muscle on top of the upper leg which extends the lower leg and straightens the knee.

After the operation, the patient must learn how to use the transposed healthy muscle. This knowledge does not come spontaneously or by a trial and error process of learning. The patient "discovers" how to use his transposed muscle after random attempts. Once discovered, however, the ability to use the muscle is immediately retained by most patients without having to learn it by repetition.

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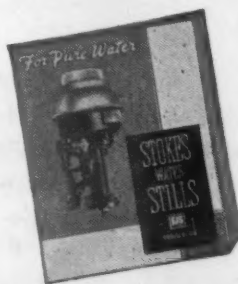
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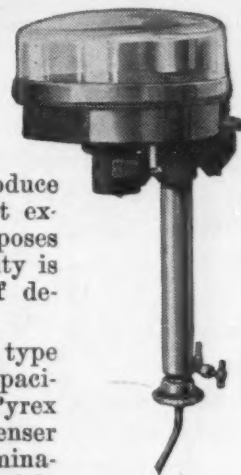


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and how much can be expected from the operation in a given case, Dr. Phemister has used an apparatus which records the electrical activity produced by the muscle in action, somewhat similar to the electrocardiogram.

Working with him under a grant from the foundation were Dr. Paul A. Weiss, Dr. C. Howard Hatcher and Dr. Paul Brown.

### NEW SOURCE OF FISH OIL VITAMINS IN PERU

THE United States can have a new source of needed vitamins from fish oils and Peruvians can improve their diet, if Peru's wealth of fish is made the basis of an expanding fishing industry, is shown by a survey made by three U. S. Government experts.

Charting a purse seiner, investigators sailed their boat through Peruvian waters, trying experimental fishing with nets, trawls and harpoons, and visiting Peru's fish markets on land. A survey of Venezuela's fishing possibilities is expected to follow, and plans are being studied to survey the whole sweep of Latin American waters from the Caribbean to Cape Horn, with the cooperation of countries concerned. Peru financed virtually all the expedition's cost, and purchased the exploring fishing boat at the end of the project.

Peru has about a hundred varieties of fish used for food and sixty or more are common in certain markets there. But, while rail facilities for shipping fresh fish inland are adequate from the port of Mollendo and the inland cities would like fish, relatively little sea food is being shipped there, and prices in some cases are higher than meat per pound.

As a source of protein, mineral and vitamin ration, fish are pronounced an industry worth expansion in Peru. Those who made the survey are specialists in fishing problems from varied angles, including marketing, canning, smoking and freezing. They are R. H. Fiedler, chief of the Fish and Wild Life Service's division of fishery industries, Norman D. Jarvis, technologist, and Milton J. Lobell, biologist.

Tuna, bonito and other fish found in the Peruvian waters are pronounced a valuable source of fish liver oils for export trade. Cut off from European sources of vitamin-bearing fish oils, the United States could absorb large quantities of these products for human consumption and for livestock, and there is considered a possibility that the American republics could build up a post-war trade in world markets.

### ITEMS

THE earth, indifferent to censorship, carried its own news dispatches of the quake that rocked Formosa on Wednesday, December 17. The seismographs of St. Louis University show that the disturbance began at 3:26.9 A.M., Formosa time, on December 17.

PRECAUTIONS against the off chance of an air raid have been taken at the National Zoological Park in Washington. In addition to the usual instructions on what to do to prevent fire from spreading, rifles have been placed in certain of the animal houses for use in case the more

formidable specimens should be accidentally released from their cages and prove impossible to round up. Zoo attendants are cautioned not to remove these weapons, unless they should be needed for combating parachute troops. Poisonous reptiles have not been killed, as they were in European zoological parks at the beginning of the war. The reason is, that if even cobras or rattlesnakes were to get out, the chill winter air would numb them in a short time. Only in case a poisonous reptile gets loose and remains within the reptile house, where it is warm, is it considered necessary to kill it.

DROUGHT in the Southeast was driven into farther retreat by heavy rains during the past week is shown in the U. S. Weather Bureau's survey of crop-weather conditions. Topsoil was put into better condition, wells and stock ponds replenished. However, still more rain is needed to bring subsoil moisture back to normal. Temperatures were lower than normal in the central part of the country, but above normal in the East and from the Rocky Mountains westward. Sub-zero weather, however, was limited to a few relatively small areas. Frozen fields helped in the northern Corn Belt, by enabling corn-picking machinery to move on the hard surface. A statistical study shows that 16 out of the past 20 winters have been warmer than average, as recorded at 29 widely distributed observatories.

THE need for better wood utilization was stressed by C. W. Strauss, of the U. S. Forest Service, speaking at the meeting in Jacksonville of the Society of American Foresters. Miscut lumber turned out by small sawmills represents a waste of from \$6,000,000 to \$10,000,000 a year; damage by termites and decay probably as much as \$20,000,000; and there are many other places where wealth in wood dribbles away. There is also a tremendous waste in parts of trees now discarded in lumbering operations, simply because woodland owners and sawmill men can not be bothered to get the value out of stumps, tops and broken timber.

E. L. DEMMON, director of the Southern Forest Experiment Station of the U. S. Forest Service, stated that research during the past twenty years has been of great benefit to Southern forestry industries, now called upon to yield as never before for the support of the American war effort. Two research centers have participated in the program. One is at New Orleans, where he has his headquarters; the other is at Asheville, N. C. The Forest Products Laboratory at Madison, Wis., has also done a good deal of work on materials shipped to it. Among the problems on which research has been conducted, Mr. Demmon listed: Methods of thinning, improving and cutting second-growth southern pine stands to obtain optimum growth and natural reproduction. Development of improved techniques for seed procurement, nursery and planting practices. Study of effects of fire, and use of fire for silvicultural purposes. Information on relation of physiological factors to forest growth. A comprehensive survey of forest areas totaling millions of acres. Studies of influences of forests on soils and water.

# SCIENCE

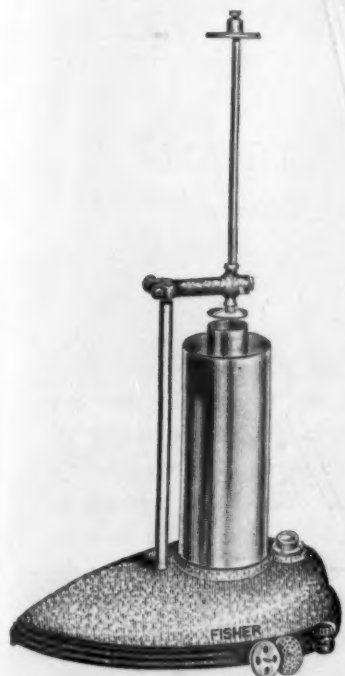
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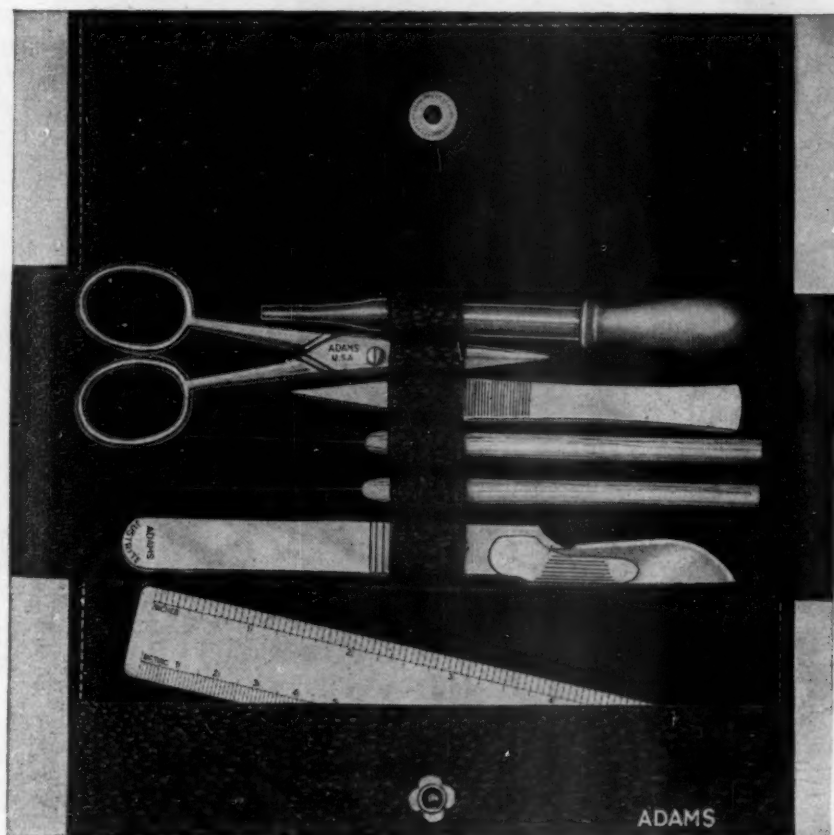
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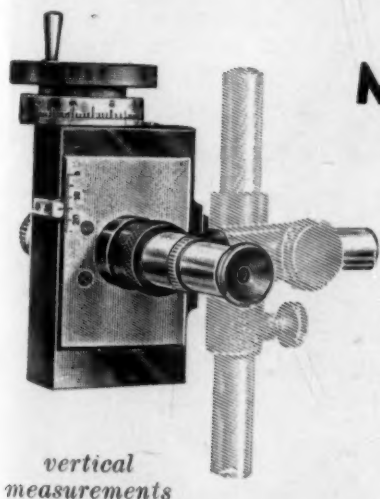
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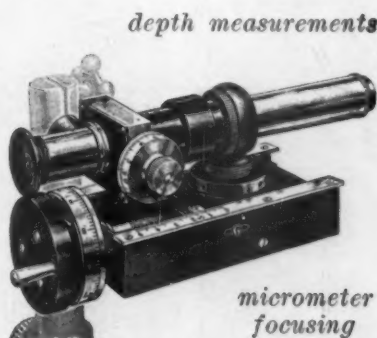
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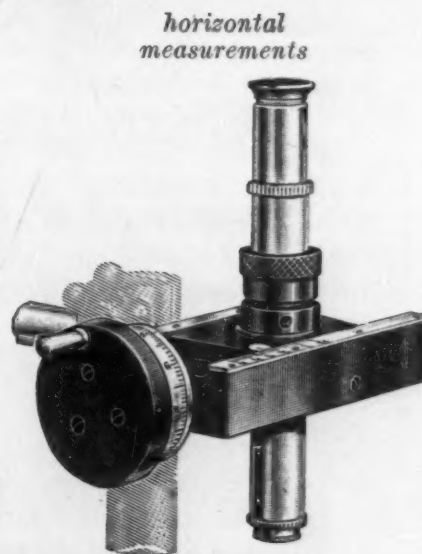


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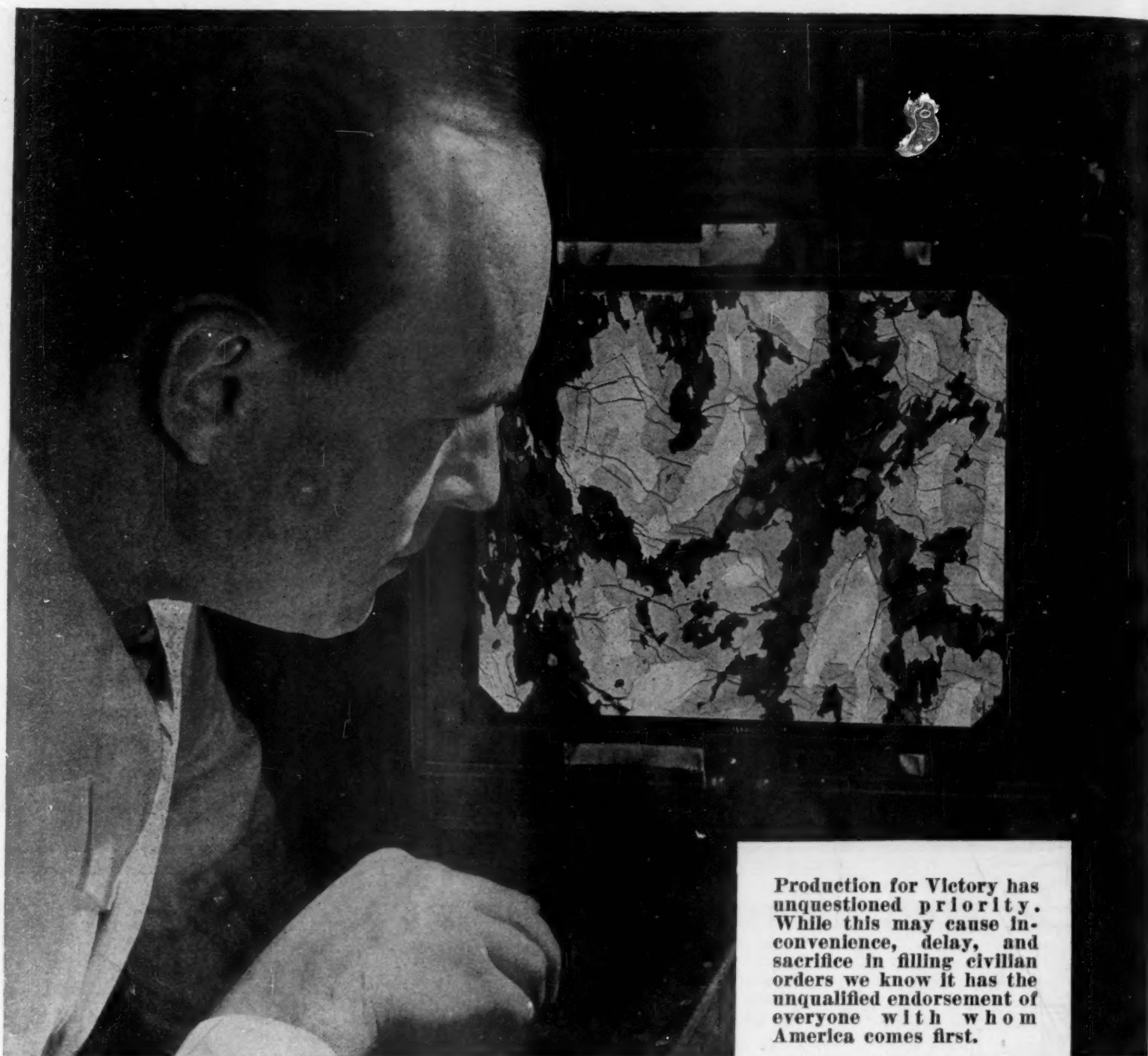
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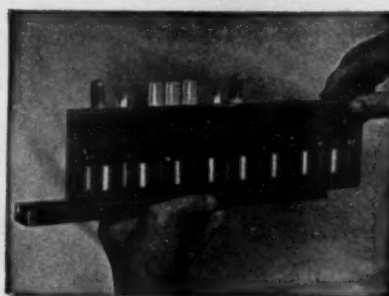
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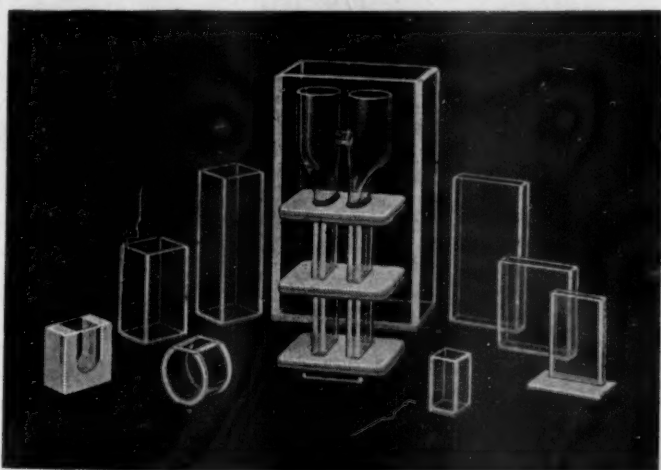
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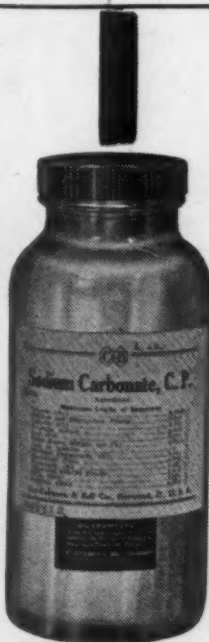
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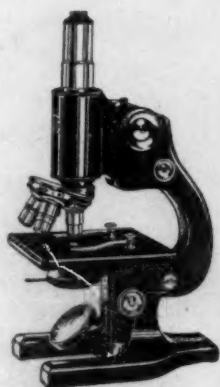
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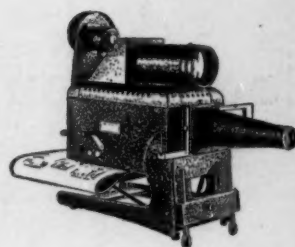
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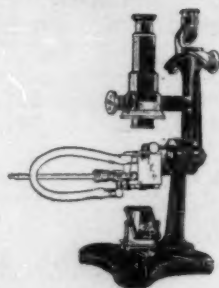


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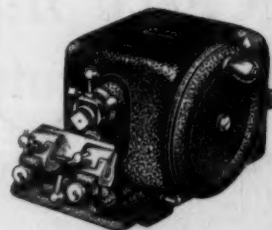
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